RECONNAISSANCE REPORT SEDIMENTATION PROBLEM

QUINCY BAY, ILLINOIS

SEPTEMBER 1987

US Army Corps
of Engineers
Rock Island District

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
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REPLY TO
ATTENTION OF:

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RECONNAISSANCE REPORT
SEDIMENTATION PROBLEM

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ACKNOWLEDGEMENT

Many members of the Rock Island District assisted in the preparation of this report. Primary study team personnel who directly contributed to the study are listed below:

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SYLLABUS

Quincy Bay is a complex backwater area along the Mississippi River adjacent to the city of Quincy, Illinois. Hunting, fishing, and boating are common recreational activities in the bay. Sediment accumulation in Quincy Bay has been a concern for many years. The change in water flow patterns and sediment accumulation following the construction of Lock and Dam 21 in the 1930's and, more recently, the opening of a small-boat access channel in the late 1960's have caused this concern. Local citizens have requested corrective action since 1975.

This report presents a summary of existing data, much of which has been provided by other sources (see Acknowledgement). The available information is adequate to assess alternative means of alleviating the sedimentation problems. Thus, this report outlines several proposals to enhance recreational opportunities and to reduce the rate of sedimentation in Quincy Bay.

The investigations conducted by the Illinois State Water Survey show that under immediate post and present conditions about 245,000 tons of sediment is deposited annually in the Quincy Bay backwater area. Of this, about 70 percent is attributable to Mississippi River flooding, 22 percent is transported through the access channel, and about 8 percent is delivered by creeks that drain into Quincy Bay.

This study evaluated several solutions to reduce the sedimentation problem in the Quincy Bay area and the possible opportunity to enhance the recreational potential of the area. The most effective way to reduce sedimentation in the bay area would be to construct a levee from the railway embankment upstream to the Indian Grave Drainage District levee. This levee would close the upper Quincy Bay access channel and greatly reduce sedimentation from high flows on the Mississippi River. A partial economic evaluation indicates that this solution would not be economically justified by a wide margin.

The upper Quincy Bay access channel has been depositing sand in its lower reach where it flows through Broad Lake. The channel through Broad Lake has gone from 20 feet deep in 1969 to only a few feet deep in 1985. If this access channel is to remain open, dredging would be required for boat access in the near future. A channel restriction consisting of a submerged rock dike across the upper reach of the access channel is expected to reduce the sediment load the channel is presently carrying. A conservative analysis indicates that the construction of a submerged rock dike across the access channel would reduce potential dredging costs by enough to be economically justified.

The report recommends that no further Federal action be taken under the 1980 authority for this report.

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SECTION 1 - INTRODUCTION

STUDY AUTHORITY

In November 1984, the Rock Island District, Corps of Engineers, initiated a reconnaissance study of sedimentation problems in Quincy Bay, located on the Mississippi River near Quincy, Illinois. The study authority is a 1980 Congressional Resolution (see page B-1 of Appendix B - Pertinent Correspondence). The study was a combined effort of Federal and State of Illinois agencies and the Quincy Park District.

STUDY PURPOSE AND SCOPE

STUDY PURPOSE

The study's purpose is to determine the advisability of improving the project study areas for recreational navigation and rehabilitation and enhancement of wildlife habitat.

STUDY SCOPE

The Quincy Bay area has a history of sedimentation problems. Alleviation of these problems was investigated in the interest of navigation, recreation, and fish and wildlife.

DELINEATION OF STUDY AREA

The Quincy Bay area, located in Adams County, Illinois, occupies all or portions of several townships in Township 1 South and Range 9 West. The overall bay area is about 4 miles long by 2 miles wide and is composed of an associated complex of interconnected channels and small bays, as shown on plate 1. The total water surface area is 525 acres.

Quincy Bay proper is a 3-mile-long by 400- to 2,000-foot-wide body of water extending north along the bluff line in Illinois from river mile 327 above Cairo, Illinois, on the Upper Mississippi River. The city of Quincy, Illinois, is located near the bay outlet.

In this report, "Quincy Bay" refers to the entire bay area which includes: Lower, Middle, and Upper Quincy Bay; Twin Oaks; Bay Island Access Channel; Lower and Upper Broad Lake; Willow Slough; Triangle Lake; Long Lake; and Quinsippi Island, as identified on plate 2.

RELATED STUDIES, REPORTS, AND EXISTING WATER PROJECTS

RELATED STUDIES

The Illinois Department of Conservation contracted with the Illinois State Water Survey Division, Champaign, Illinois; and Huff and Huff, Inc., Environmental Consultants, LaGrange, Illinois, to provide the basic data used in this study.

The sedimentation study conducted by the Illinois State Water Survey consisted of two parts: (1) measurement of present water depths, sediment depths, and sediment properties; and (2) analysis of sediment transport in channels in the bay and by tributary streams. A survey of water and sediment depths was conducted, and suspended sediment and water discharge was measured at several locations. A computer model was used to study the impact of Mississippi River floods on sediment deposition in Quincy Bay. The draft Final Report with a list of possible corrective actions was provided to the Rock Island District, Corps of Engineers, in October 1986. These possible corrective actions were evaluated as a part of this study.

Huff and Huff, Inc., conducted an independent study of the recreational use of Quincy Bay. The study included a user survey of recreational boaters using the Quincy area boat ramps and marinas. Approximately 1,260 recreational interviews were recorded. The information gathered was used to analyze the economic value of current and potential recreational activities. The final report, detailing estimates of annual usage rates, specific recreational use information, and additional demand for marina slips, was submitted to the Illinois Department of Conservation and received by the Rock Island District, Corps of Engineers, in February 1986. Results of that final report also were incorporated into this study.

RELATED PROJECTS

There are three Corps of Engineers small-boat projects in the Quincy Bay area. The first of these, which was authorized by the River and Harbor Act of 1962, consists solely of periodic maintenance dredging of Lower

and Middle Quincy Bay. The second is a small-boat harbor in Squaw Chute, authorized under Section 107 of the 1960 River and Harbor Act, which was completed in 1966. The third project is an access channel from Quincy Bay to the main channel Mississippi River, which was authorized under Section 107 of the 1960 River and Harbor Act and completed in 1969. These projects are identified on plates 3, 4, and 5, respectively.

SECTION 2 - PLAN FORMULATION

ASSESSMENT OF WATER AND LAND RESOURCE PROBLEMS AND OPPORTUNITIES

PROBLEMS AND OPPORTUNITIES

Sediment accumulation in Quincy Bay has been a concern for many years. Changes in water flow patterns and sediment deposition followed the construction of Lock and Dam 21 in the 1930's. Actually, the detention of water caused by the dam permanently raised water levels at Quincy Bay, thereby creating depths of water that made formerly inaccessible areas accessible to larger recreational craft. Plate 6 reveals the topography of Quincy Bay in 1929, prior to the completion of Lock and Dam 21 in 1938.

As time has passed, Mississippi River flood flows and tributary streams have deposited sediment throughout the bay. Many areas of the bay which were accessible when the lock and dam was first put into operation are now inaccessible by all but the smallest of craft. The only areas which appear to be navigable to larger recreational craft are Squaw Chute Harbor, Lower Quincy Bay, and the upper reach of the Bay Island Access Channel. Plates 7, 8, 9, and 10 show how the river bottom cross-sectional profiles have changed (due to sedimentation) since Lock and Dam 21 first went into operation (1938) through 1978.

A more recent survey, compiled by the Illinois Institute of Natural Resources, State Water Survey Division, reveals 1985 water depths at normal pool in selected areas of Quincy Bay. These depths are compared to depths recorded when the lock and dam went into operation and by an informal survey conducted in 1975, as shown on plate 11. Hence, water depths throughout the bay have decreased.

Local residents believe that the opening of the small-boat access channel in 1969 has changed flow patterns and is the crux of the sedimentation problem in Quincy Bay.

The Quincy Park District desires a rejuvenation of the bay's recreational potential in terms of boating, waterskiing, fishing, and hunting. To fulfill these desires, measures to improve the recreational potential and to enhance the environmental quality of Quincy Bay have been proposed, evaluated, and either recommended for or dropped from further consideration based on technical, economic, and environmental criteria.

EXISTING CONDITIONS

General

Prior to the formation of the Indian Grave Drainage District (plate 2) in the 1880's, Quincy Bay proper was the outlet channel for Bear, Rock, Ursa, Frazier, and Homan Creeks. The total drainage area was about 400 square miles, and the average water discharge was about 240 cubic feet per second (ft^3/s). By 1886, the drainage district had constructed its levees and diverted Bear, Ursa, and Rock Creeks directly to the Mississippi River.

Also during the late 1800's, a swing span railroad bridge was constructed across the Mississippi via Quinsippi Island. At this time, the Mississippi River navigation channel and hence the swing span of the bridge were located on the Missouri side of the river.

The Corps of Engineers began removing snags from the Mississippi River as early as 1824 to assist navigation. In 1878, the 4.5-foot-deep navigation channel project was authorized and construction was begun on wing and closing dams to direct more of the river discharge into the navigation channel during moderate and low-flow conditions. In 1907, a 6-foot navigation depth was authorized by Congress, and more structures were built to further constrict the flow area.

By 1918 it was evident that the lower end of the Indian Grave Drainage District, known as Triangle Lake, did not drain well. Consequently, Triangle Lake was abandoned by the drainage district and the 17.1 square miles of Frazier-Homan Creek basin was diverted directly to the upper end of Quincy Bay. In 1928, an electric pumping station was constructed to pump storm water from the drainage district into the bay.

In 1930, Congress authorized the 9-foot navigation project which depends upon lock and dam structures as well as wing and closing dams to maintain the design depth of water. Lock and Dam 21 at river mile 324.9 (plate 1) was put into operation in 1938 and established a low-water pool elevation of 470 feet mean sea level (MSL).

With the lock and dam in operation, Quincy Bay became a backwater of the Mississippi River rather than the outlet channel for Bear Creek and Frazier Creek. At this time, some of the area west of the original bay, or main bay, became permanently flooded as part of the Lock and Dam 21 backwater. Plate 6 shows the topography of the area in 1930 prior to construction of the lock and dam.

Sedimentation posed a serious problem in Quincy Bay proper above the Cedar Creek delta. Although the area was dredged to 8 feet, siltation rapidly reduced the average depth to 3 feet. To alleviate the sedimentation in

the upper part of the bay, flows from the Indian Grave Drainage District and Frazier Creek were diverted from Upper Quincy Bay into Triangle Lake in 1956. Although this measure has slowed the sedimentation rate in the upper bay, Triangle Lake has all but filled with sediment.

Between 1958 and 1960, the Corps of Engineers relocated the navigation channel from the Missouri side to the Illinois side of the Mississippi River. This required the Chicago, Burlington, and Quincy Railroad to construct a new fixed channel span bridge across Quincy Bay. The old bridge was removed, except for the span between Quincy and Quinsippi Island which was retained for access to the park on the island. The new bridge across the bay is 500 feet north of the old bridge (plate 2). For navigational clearance, low steel elevations on the new bridge were required to be above elevation 530 feet MSL, thereby requiring a high embankment on Quinsippi Island. Fill for this embankment was dredged from a backwater area of Quincy Bay located directly north of the railroad alignment. This dredging created a 25- to 30-foot-deep backwater area which became known as Broad Lake (plate 2).

In the 1960's, four Federal projects were undertaken in the Quincy Bay area. The River and Harbor Act of 1962 authorized the Corps of Engineers to perform maintenance dredging of Middle and Lower Quincy Bay (plate 3). This dredging, performed in the interest of recreational navigation, was to include an area of Quincy Bay proper beginning at its confluence with the Mississippi River, through the Cedar Creek delta, terminating about 9,000 lineal feet up the bay in the vicinity of Bangert Park (otherwise known as "The Narrows"). This area of the bay was to be dredged to maintain a depth of 5 feet and width of 300 feet.

In 1966, the Corps of Engineers constructed the Squaw Chute small-boat harbor (plate 4). This project, authorized under Section 107 of the River and Harbor Act of 1960, was undertaken to meet the demand for additional mooring facilities for recreational craft in Quincy Bay.

In the late 1960's, the Corps reconstructed and raised levees in the Indian Grave Drainage District (plate 2). The levees, damaged by the 1965 flood, were repaired and raised to a 50-year level of protection. This improvement was authorized by the Flood Control Act of 1954, Public Law 780.

In response to requests from local boaters for direct access to Broad Lake, the Corps constructed a small-boat access channel across Bay Island (plate 5) in 1969. This channel provided access for small recreational craft from Quincy Bay proper to the main channel Mississippi River without the need to navigate around the downstream tip of Quinsippi Island. The channel, with a bottom width of 50 feet and some 6,000 feet in length, was authorized under Section 107 of the River and Harbor Act of 1960.

By 1971, the upstream end of the access channel had scoured its bed to a size several times the design cross-sectional area, as shown on plate 12 (provided by the Illinois State Water Survey). Also, since its opening in

1969, the access channel has been dredged as shown in table 1. This sedimentation is caused by sediment flowing from the Mississippi River into the access channel where the water velocity is considerably slower. The lower velocities cause sediment accretion and reduced access channel depth. The access channel has changed the pattern of water movement in Quincy Bay and caused increased sedimentation, not only in the access channel itself, but in lower Broad Lake and possibly in Middle and Lower Quincy Bay as well.

TABLE 1

Corps of Engineers
Maintenance Dredging
Quincy Bay Area

Year	Location	Cubic Yards Dredged
1968	Squaw Chute Harbor Entrance	6,741
1971	Quincy Bay Access Channel	6,053
1972	Access Channel and Middle Quincy Bay	8,028
1973	Access Channel and Middle Quincy Bay	5,063
1975	Access Channel and Middle Quincy Bay	5,545
1981	Squaw Chute Harbor Entrance	2,000

In 1971, rock was placed at the upper end of the access channel in an effort to reduce scour. Since high velocity flows eroded the previously placed rock, more rock was placed in 1973 and again in 1975. At that time, enough rock was placed to form a blanket or low weir at the upper end of the access channel. At the present time, the condition of the blanket is unknown.

By 1975, local boaters, fishermen, and duck hunters were so concerned about the shoaling in many chutes, sloughs, and lakes within the Quincy Bay area that some of them conducted a hydrographic survey of the bay. The survey showed average water depths in areas of Quincy Bay at the time.

Since the 1975 survey, public concern over the sedimentation problem at Quincy Bay has escalated. As a result, efforts were begun to obtain Federal or State funds to determine the causes of the problem and to find measures to prevent future sedimentation and rehabilitate some parts of the bay.

In 1984, the Illinois Department of Conservation obtained funds to let two contracts: one for a recreational study (conducted by Huff and Huff, Inc.) and the other for a sedimentation investigation (conducted by the Illinois Institute of Natural Resources, State Water Survey Division). At the same time, the Rock Island District, Corps of Engineers, obtained funds to conduct a reconnaissance study of Quincy Bay.

In 1985, as a part of its sedimentation investigation, the Illinois State Water Survey determined average water depths and volumes of sediment in the bay. The State Water Survey compared these data to data compiled at the time Lock and Dam 21 was put into operation (1938) and data compiled as a part of the 1975 survey as shown in table 2. The accuracy of these values varies according to the source of data and method of calculation. Table 3 summarizes the quality of the data and analysis by segment and year. In general, the quality rating of the calculated volumes would be very good for the 1985 data, good to poor for the 1938 data, and poor for the 1975 data. Plate 11 shows a comparison of the water depths as compiled by the three surveys.

The sedimentation investigation concludes that about 245,000 tons of sediment is deposited annually in Quincy Bay. Of this, about 70 percent (171,500 tons) is attributable to Mississippi River flooding, 22 percent (53,900 tons) is transported through the access channel, and about 8 percent (19,000 tons) is delivered by Frazier Creek and other tributaries to the bay.

Hydrologic and Hydraulic Conditions

General

As previously mentioned, the Quincy Bay area is about 4 miles long by 2 miles wide and located at approximately mile 328 on the Mississippi River, or about 3 miles upstream of Lock and Dam 21 (plate 1). The land areas are typically less than 10 feet above normal pool at Lock and Dam 21 and are forested with bottomland deciduous trees. The total water surface area is about 525 acres. The drainage area of the Mississippi River at the dam is 135,000 square miles. The average slope of the bed of the river is 0.51 feet per mile through the 18.3-mile reach included in Pool 21.

Major tributaries to Quincy Bay include Cedar Creek, Frazier Creek, and Bear Creek, which is the main ditch in the Indian Grave Drainage District. Drainage areas in acres are: Cedar Creek, 5,100; Frazier Creek, 10,700; Indian Grave Drainage District, 17,000; and direct drainage, 2,640. The direct runoff areas, Cedar Creek and Homan Creek (a tributary of Frazier Creek with a drainage area of 4,900 acres), are in the city of Quincy or residential areas north of Quincy. The remainder of the Quincy Bay tributary watershed is rural. Most of the area of these watersheds is on top of bluffs which are about 100 to 150 feet high. The Indian Grave Drainage District is entirely level bottomland in agricultural use and is leveed for flood protection. The outflow from the drainage district is pumped into Triangle Lake (plate 2).

Climate

The general Quincy area is subject to weather ranging from that of the cold, dry winter with temperatures as low as -19 degrees Fahrenheit, to hot, humid conditions with temperatures reaching 114 degrees Fahrenheit.

TABLE 2

Comparison of Data Compiled by
Illinois State Water Survey

Bay Area	Year of Origin	Area (acres) Original	1985	Average Depth (feet) Original	1975	1985	Volume (acre-feet) Original	1975	1985	Rate of Loss/Gain () Original to 1975	1975 to 1985 (%/year)	Original to 1985
Quincy Bay Proper Total	1938	293.0	288.0	----	----	----	2,454.0	1,091.0	927.4	1.5	0.7	1.3
Lower Quincy Bay	1938	76.2	71.2	9.47	5.45	5.64	721.6	415.3	401.7	1.1	0.2	0.9
Middle Quincy Bay	1938	64.5	64.5	7.26	3.60	2.45	468.3	232.2	158.3	1.3	1.6	1.4
Upper Quincy Bay	1938	109.8	109.8	9.11	3.09	2.58	1,000.3	339.3	282.8	1.8	0.6	1.5
Triple Oaks	1938	42.6	42.6	6.19	2.45	1.99	263.7	104.4	84.6	1.6	0.7	1.4
Access Channel Total	1969	48.0	34.3	----	----	----	----	----	----	---	---	---
Lower Access Channel	1969	43.3	28.4	20.00	10.70	4.63	866.0	462.4	132.9	7.8	3.8	5.3
Upper Access Channel	1969	4.7	5.9	4.74	26.00	16.02	22.5	123.2	94.4	(75.0)	12.8	(20.0)
Broad Lake Total	1969	125.0	97.5	----	----	----	----	----	----	---	---	---
Lower Broad Lake	1969	21.6	10.9	20.00	8.50	1.79	432.0	183.6	19.5	9.6	3.8	6.0
Upper Broad Lake	1969	104.0	86.6	2.53	1.85	0.73	262.4	191.9	62.9	4.5	4.9	4.8
Willow Slough	1969	47.5	47.5	3.37	----	1.84	160.1	----	87.5	---	---	2.8
Triangle Lake	1956	125.0	77.6	5.63	----	0.37	702.6	----	28.5	---	---	3.3
Long Lake	1969	12.3	12.3	4.00	2.00	0.5	49.2	24.6	6.2	8.3	3.7	5.5
Triangle Lake Access	1956	10.8	10.8	4.00	----	2.0	43.2	----	21.6	---	---	1.7
Quincy Bay Area Total		662.0	568.0	7.50	3.90	2.4	4,992.0	2,215.0	1,381.0	---	---	---

TABLE 3

Quincy Bay Volume
Calculation Summary
(Compiled by Illinois State Water Survey)

Bay Area	Original	1975	1985	Original Depth Comment	1975 Data Quality
Lower Quincy Bay	3	4	1	Solid	Poorly distributed
Middle Quincy Bay	3	4	1	Soft	Limited number
Upper Quincy Bay	3	4	1	Soft	Good
Triple Oaks	3	4	1	Solid	Good
Lower Access Channel	5	4	2	1969 Corps survey	Good
Upper Access Channel	5	4	2	1969 design	Poor
Lower Broad Lake	5	4	1	1969 Corps survey	Good
Upper Broad Lake	3	4	1	Solid	Good
Willow Slough	3		1	Solid	
Triangle Lake	3		1	Poorly distributed	
Triangle Lake Access	5		5*		
Long Lake	4	4	5*		Good

1) stage vs: area = volume
2) unadjusted end area - width
3) adjusted end area - width
4) average of depth readings
5) estimated from other sources
* based on field observation

The navigation or ice-free conditions exist from late February or early March to mid-December. The mean annual precipitation for the area is 32.1 inches, with a mean annual runoff of 6.88 inches from the entire drainage basin.

Floods

Major historical floods have occurred from a combination of snowmelt and heavy general rains over the Upper Mississippi River Basin. The maximum discharge was 408,000 ft^3/s in 1978 and resulted in flooding to elevation 487.5 feet MSL at the Quincy gage. Table 4 lists the floods above 17.0 feet, or elevation 475.59 feet MSL, at the Quincy gage which is located at mile 327. Plate 13 shows the major flood profiles in the Pool 21 reach, and plate 14 shows the flood discharge-frequency relationship. The minimum flow has been estimated to be 6,400 ft^3/s, which occurred in 1934. The lowest water surface elevation since the dam went into operation in 1938 is 453.9 feet MSL. Plate 15 shows the elevation-duration relationships at several locations in Pool 21.

TABLE 4

Quincy, Illinois
Stages Greater Than 17 Feet*

Year	Stage (feet)
1947	23.8
1948	21.5
1950	19.0
1951	22.8
1952	21.9
1960	24.30
1961	19.50
1962	21.30
1965	24.8
1967	19.30
1969	21.80
1970	17.60
1972	17.20
1973	28.90
1974	23.00
1975	20.90
1976	22.20

* 17-foot gage = Elevation 475.59 (4th G.A.)

Sediment Discharge

The Rock Island District, Corps of Engineers, currently maintains a suspended sediment sampling station at Keokuk, Iowa, on the Mississippi River. This station is approximately 37 river miles upstream of Quincy Bay and has a drainage area of about 119,000 square miles. Based on the records for 15 years of data at the sediment station, the average annual suspended sediment load of the river is about 11.9 million tons. Plate 16 shows a size gradation curve developed from limited size data at the Keokuk station. Based on work done by Tatsuaki Nakato, as presented in IIHR Report No. 227 published by the Iowa Institute of Hydraulic Research, April 1981, entitled, Sediment-Budget Study for the Upper Mississippi River, GREAT II Reach, Pool 21 is, on the average, in-trapping sediment at the rate of about 0.9 million ton per year for the area below the normal pool level based on uniform distribution.

In a report entitled Investigation of Sedimentation in Quincy Bay by the State Water Survey Division of the Illinois Institute of Natural Resources, sedimentation rates in Quincy Bay are estimated to be 0.08 foot per year due to average Mississippi River suspended sediment deposition and

up to 2.0 feet per year resulting from deposition of bedload and locally eroded material. This unusually high rate of deposition of bedload material is primarily the result of the access channel constructed at the insistance of the local boaters in 1969 as shown on plate 5.

Economic Conditions

Quincy Bay has long served as a valuable source of recreation for residents along Pool 21 on the Mississippi River. A 1974 survey indicated that approximately 216,000 recreational visits were made to Quincy Bay in that year. A more recent survey showed that approximately 180,000 recreators visited Quincy Bay in 1985 and participated in a total of 246,000 activity days. Over 97 percent of these users originated within 25 miles of Quincy Bay, with more than 80 percent of the visitations occurring during the spring/summer season.

Recreational activities in the area are dominated by boating. Of 246,000 activity days recorded in 1985, boating accounted for almost 44 percent. Fishing, swimming, and waterskiing comprised an additional 36 percent of the activities. Survey results indicate that Quincy Bay is used primarily as an access point to the Mississippi River. Within the bay itself, waterskiing, hunting, and fishing are the main activities.

Kesler Park, as identified on plate 2, is the site of greatest usage in Quincy Bay. Equipped with multi-ramp facilities and other recent improvements, this site accounts for almost 23 percent of total usage in the area. Other important boating sites include Bob Bangert Park and Squaw Chute Marina, as shown on plate 2. Quinsippi Island is another major usage site primarily for picnicking and sunbathing. Together, these four sites account for over 74 percent of the visits to the bay. The cottages located along Quincy Bay provide another main source of recreation. Approximately 9.5 percent of the annual user days are associated with the participation of residents who directly access the bay for boating, fishing, and swimming.

The Squaw Chute Marina is the only marina facility in the Quincy Bay area. Built in 1969, the facility was gradually expanded until attaining its current size of 208 slips. An existing demand for additional marina facilities is evidenced by the waiting list at the marina. Projected increases in boating activity and registration indicate that an additional 52 to 99 slips will be needed in the area by the year 1990.

Environmental Setting and Natural Resources

The reconnaissance study has been coordinated with the U.S. Fish and Wildlife Service and the Illinois Department of Conservation. A Planning Aid Report from the U.S. Fish and Wildlife Service, dated 24 April 1986,

can be found in Appendix B - Pertinent Correspondence. Two letters from the Illinois Department of Conservation also can be found in appendix B, one dated 2 June 1986 commenting on the Planning Aid Report and one dated 6 June 1986 commenting on management aspects of the bay and potential disposal sites.

The Quincy Bay study area has experienced several dramatic changes over the past 50 years. Prior to the construction of Lock and Dam 21, the study area was primarily wooded with less open water area than exists today. The impoundment created by the lock and dam expanded the backwater areas, and, approximately 20 years later, borrow taken from Broad Lake for the construction of the Chicago, Burlington, and Quincy Railroad embankment at the north end of Quinsippi Island expanded and deepened the lake. Again, about 10 years later an access channel connecting Quincy Bay proper with the main channel of the Mississippi River was constructed.

Other notable events which have changed the area include the land use change of the Triangle Lake area from agricultural use to a sediment trapping function; the development of parts of lower Quinsippi Island to recreational uses; and the realignment of the Mississippi River navigational channel from the Missouri side of the river to the Illinois side. More detailed accounts of events and features which have contributed to the area as it exists today can be found under the "General" and "Cultural Resource" subheadings of the "Existing Conditions" section of this report, and in the U.S. Fish and Wildlife Service's Planning Aid Report (Appendix B - Pertinent Correspondence). All of the foregoing events have had both beneficial and adverse effects on the natural resource character of the area, but the overriding change causing the greatest concern is the relatively rapid sedimentation of the backwater areas.

The study area is a complex of wooded islands and backwater areas. Trees observed in more readily accessible parts of the study area are typical floodplain species: silver maple (Acer saccharinum), cottonwood (Populus deltoides), and willow (Salix sp.) being found at lower elevations and grading into mulberry (Morus sp.) and elm (Ulmus sp.) at intermediate elevations. Sycamore (Platanus occidentalis), box elder (Acer negundo), and ash (Fraxinus sp.) are additional floodplain species which could be expected to be found at intermediate elevations.

One notable area, which was reported by an Illinois Department of Conservation officer familiar with the area, is the wooded portion of Triangle Lake which consists of about 80 percent pin oaks (Quercus palustris). Triangle Lake is about 250 acres in size and is managed by the Illinois Department of Conservation as a waterfowl refuge. The Department of Conservation considers Triangle Lake to be the most valuable waterfowl resource in the study area. The study area provides the requirements of migrant waterfowl for breeding, resting, and feeding.

Duck hunting is popular in the area. However, sedimentation of the backwaters is resulting in reduced hunting, which is expected to continue due to habitat loss during low water years and increasing inaccessibility.

As reported by the U.S. Fish and Wildlife Service in their Planning Aid Report, in addition to waterfowl, the bay area is used by a diversity of wildlife. Notable among these is the river otter (Lutra canadensis), a State of Illinois "threatened" species, and a great blue heron (Ardea herodias) rookery near the northern end of the study area. A bird survey of the general area in 1980 identified 803 birds, composed of 52 species. The observers reported seeing six large raptor species during other studies.

The U.S. Fish and Wildlife Service's Planning Aid Report describes electroshocking fish surveys in the study area, indicating a diverse fishery which has apparently not changed significantly over the past 10 years. The two areas sampled, however, may be areas of less sedimentation impact than the bay area in general and thus not representative. The surveys, however, do illustrate the potential benefit to the fishery from deepening heavily impacted areas of the bay.

The Planning Aid Report provides the names of two federally listed endangered species which do or could occur in the study area:

Bald eagle (Haliaeetus leucocephalus)

Indiana bat (Myotis sodalis)

Both species would use trees to satisfy habitat requirements. The Indiana bat would be present during the summer months and would use the shelter provided by cavities or peeling bark on standing trees for maternity roosts. As a food source, the bats would exploit nocturnal flying insects. During the winter, the bats hibernate in caves. There are no caves in the immediate study area, and currently there are no reports of Indiana bats having been sighted in the study area.

Eagles are reported to be present in the study area during the winter months. The eagles use shoreline trees as resting and feeding perches and prey on fish as a primary food source. Eagles often will use tree stands near the river for night roosting in warmer weather, but during severe weather would depend on sheltered ravines or valleys. No severe weather, sheltered night roosts are known to be in the study area. During colder weather when freeze over is probable, the eagles are likely to be found downstream of Lock and Dam 21 where turbulence keeps the water open. During the summer months, the eagles migrate north.

Any efforts to rejuvenate the bay area would probably involve dredging and disposal operations and could require Section 401 Water Quality Certification from the State of Illinois. Hence, samples for water quality and particle size analyses were collected from the Quincy Bay area in July 1985 to identify any potential problems in this respect. A water quality report undertaken by the Rock Island District, Corps of Engineers, which gives methodologies, sampling sites, and analytical results, can be found in Appendix B - Pertinent Correspondence.

The results of the particle size analyses were essentially the same as similar tests conducted by the Illinois State Water Survey. In general, those bay areas which do not exhibit current flows have a silt/clay substrate. The access channel experiences a brisk current and has a sand bottom. As the current from the access channel winds through the area, past the marina, and to the mouth of the bay, the substrate contains more silts and clays mixed with the sand.

Ambient water quality analyses were performed at one site in the Middle Quincy Bay area. For the parameters measured, the results indicate conformity with State water quality standards. Water quality in the bay area would thus be considered generally good. The bay waters tend to be turbid and any disturbance to the substrate (e.g., wind action, wave action, or turbulence from boat motors) would resuspend fine sediment particles, contributing to the turbidity.

Elutriate tests were conducted on sediment/water samples taken at five locations in the bay. The elutriate test is described in the water quality report found in appendix B and is intended to simulate river conditions during dredging. The elutriate test is thus an indirect characterization of the chemical nature of the sediments. Results from the elutriate analyses indicate that ammonia (the unionized form) would be the only parameter which might transcend its State standard if dredging were to occur in Quincy Bay. Ammonia is a colorless gas that readily dissolves in water and is normally present in natural waters as a breakdown product of nitrogen-bearing organic substances. Abnormal sources of ammonia or other nitrogen-bearing substances in surface waters could be wastewater discharges or runoff/leachates from agricultural fertilization processes. When in solution, the ammonia comes to a chemical equilibrium involving the un-ionized form (NH_3) and the ionized form (NH_4^+). The unionized form (NH_3) is recognized to be the form most toxic to aquatic life forms and hence the form to which State water quality standards usually are referenced.

Two factors which greatly influence the equilibrium proportioning of the two forms are temperature and pH. At higher temperatures and pH levels, the toxic (NH_3) form is present in greater quantities. Thus, if dredging were to occur during the fall or spring when temperature and pH values could be expected to be lower, the possibility of transcending the State standard would be lower.

The concentration of "oil and grease" liberated by the elutriate test was high at the mouth of the Squaw Chute marina relative to other sampling sites in the bay area. There is no "General Use Water Quality Standard" for "oil and grease" in Illinois. Nevertheless, if dredging were to occur at the mouth of the marina, an undesirable water quality condition might develop. The undesirable condition though would be short-term and may not be much worse than water quality conditions produced by turbulence from larger boats entering and leaving the marina. Removing the sediments at the mouth of the marina may thus have beneficial effects over the intermediate to long term.

Cultural Resources

A series of historical maps on file at the Corps of Engineers Rock Island District office indicates that the study area was significantly drier prior to installation of the Nine-foot Navigation Project Locks and Dams system. The 1881 Mississippi River Commission Map (plate 17) indicated that the majority of the study area was forested in maple, elm, and oak species. The more mesic cottonwood and willow were restricted to the southern tip of Quinsippi Island. A series of wingdams was constructed along the main river channel, and the Indian Grave Drainage District levee was built across the north end of Quincy Bay between 1890 and 1919. Notes in the margin of a base map dated 1887-1888 show that Quincy Bay was dredged every year from 1879-1886, then again in the years 1889, 1890, 1891, 1896, and 1898. The C.B.&Q. Railroad was built across the island in 1867.

By 1881, two lumber yards with associated structures were located near the southern tip of Quinsippi Island, on the east shore. The only structure shown for the island is located at the end of a railroad spur adjacent to the bay. The only standing water indicated within the island are two small lakes, one named Zimmerman and one unnamed.

The 1930 Brown's Survey Map (plate 6) shows an additional levee and road near the north end of the study area with associated structures indicated near Bear Creek. A number of structures also are present near the Cedar Creek delta and on the island across from the delta in Quincy Bay. Tree species and land use are not indicated on the 1930 map. Comparing the 1930 map with earlier maps, it is apparent that new land was forming at the southern end of Quinsippi Island and near the wing dams on the Mississippi River. A single previously recorded archeological site is present near the Canton Chute public use area in the northwest corner of the project area. Numerous archeological sites are located along the bluff top immediately east of the study area.

A series of ten (10) 1938 Corps of Engineers plane table maps are available for the study area. Plate 18 is a key to the various maps. The maps are drawn with 1-foot contour intervals and show details of vegetation, trails, and structures. Handwritten notes in the margin of map 21-PT-16 indicate that a well traveled trail that was clearly visible along the Mississippi River in 1937 had all but disappeared by 1939 due to decreased use, heavy vegetation, and inundation. This illustrates the potential for buried and obscured archeological sites within the study area.

FUTURE CONDITIONS

Conditions if no Federal Action is Taken

If no additional action is taken, the processes of water circulation and sediment scour and deposition will continue at least at their present rate. Recreational boating, hunting, and fishing will decrease with continued sedimentation. The Quincy Bay area will shift more toward terrestrial and wetland habitats and away from aquatic habitats. The access channel and bay outlet will continue to have significant water and sediment discharges passing through them and will attain a relatively stable, or dynamic, equilibrium condition in the near future.

PLANNING OBJECTIVES

NATIONAL OBJECTIVE

The national objective of water and related land resources planning is to contribute to economic development consistent with protecting the Nation's environment. Contributions to National Economic Development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct benefits and costs that accrue in the planning area and the rest of the Nation, and include increases in the net value of those goods and services that are marketed, as well as those that may to be marketed.

The plan formulation process is directed by the national planning objective:

> National Economic Development (NED) - to enhance the national economic development by increasing the value of the Nation's output of goods and services and by improving the national economic efficiency.

SPECIFIC OBJECTIVES WITHIN THE STUDY AREA

Based on an analysis of the problems and needs in the study area, the following specific planning objectives have been identified:

The Desires of Local Interests: Local interests desire dredging of Broad Lake, Triangle Lake, and Middle and Upper Quincy Bay. It is understood that local interests want to have the Upper and Middle Quincy Bay dredged primarily for recreational boating and waterskiing: Broad

Lake for recreational boating and fishing; and Triangle Lake to improve its sedimentation collection potential. Other specific objectives include: reducing the rate of sediment accumulation in the bay; providing safe boat access to the Mississippi River; providing deep backwater areas for enhancement of fisheries; and providing additional harbor facilities.

PLANNING CONSTRAINTS

The general planning constraint for this study is as follows:

> This study is constrained by all laws of the United States and by the State of Illinois, all Executive Orders of the President, and all engineering regulations of the Corps of Engineers.

The specific planning constraint applicable to the Quincy Bay reconnaissance study is as follows:

> This study is constrained by current policy which states that Federal funds shall only be used to support development of recreation facilities when the recreation benefits are less than 50 percent of total benefits. In addition, recreation benefits must be produced either jointly with other project benefits (recreation costs are not separable), or result from development of recreation potential created by projects formulated and justified for other purposes.

ALTERNATIVE PLANS

AVAILABLE MEASURES

Possible solutions considered to alleviate the sedimentation problems within the study area include dredging and other structural measures to reduce the present rate of sedimentation as well as a "No Additional Federal Action" plan. Preliminary analyses of all reasonable measures were conducted during the reconnaissance study.

Formulation Criteria

In developing a modified plan to resolve the sedimentation problem, standards and procedures were followed which have been set forth in various acts and policies and related regulations established by the Corps of Engineers. All plans considered, therefore, were evaluated in accordance with the following criteria.

Technical Criteria

The recommended plan will be consistent with design criteria, safety, and local desirability and acceptance.

Economic Criteria

Except for certain environmental or socially related instances, the average annual tangible benefits of a proposal will exceed the annual charges on the investment. The recommended plan will provide the maximum net benefits.

Environmental and Other Criteria

The public health, safety, well-being, and quality of life of the residents of the locality concerned are the prime considerations in the development of a project. Project features would be designed to disturb existing natural and cultural features as little as possible. Avoiding the loss of environmental features and providing environmental benefits would be pursued to the extent practicable.

DEVELOPMENT AND SCREENING OF ALTERNATIVE PLANS

DESCRIPTION OF ALTERNATIVE PROPOSALS

Selective Dredging

Dredging of selected areas in Quincy Bay would enhance the recreational potential and the environmental quality of the selected areas. Areas selected could be dredged to depths suitable for recreational boating and waterskiing (a water depth of at least 5 feet). To enhance the environmental quality, both shallow and deep water are desirable (depths of up to 10 feet or more).

With any dredging plan, appropriate disposal sites would need to be identified. Environmental impacts caused by the placement of excavated material would be offset by benefits attributable to dredging. If this is not the case, additional planning features would need to be considered to offset the impacts.

Four areas on Quinsippi Island considered for use as disposal areas were submitted to the U.S. Fish and Wildlife Service for their consideration. These areas are shown on figure 7 of the Fish and Wildlife Service's Planning Aid Report found in Appendix B - Pertinent Correspondence. The areas were numbered D1 through D4. All four areas are classified as wetlands. Of the four areas, the Fish and Wildlife Service judged areas D1, D2, and D4 to have the most natural resource value, with the implication that the use of area D3 would be less environmentally disruptive. The Planning Aid Report also contained the recommendation that non-wetland sand disposal areas along the west side of the island and non-wetland, undeveloped park-like areas be considered for disposal use.

Areas D5 through D7 also are shown on figure 7 of the Fish and Wildife Service's Planning Aid Report. Area D5 is primarily an agricultural site located within the Indian Grave Drainage District north of the study area. There would be some natural resource impacts from using this site, but they would not be considered significant. Factors of concern to the drainage district would be keeping dredged materials out of the district's drainage system and that the disposal activity does not detract from the site's agricultural value. Site D6 is about half wooded and half former agricultural land. With efforts to contain dredged material and to avoid killing trees, this site could possibly be acceptable to project reviewers. Site D7 is the Triangle Lake area, a State waterfowl refuge. Any disposal activities here would be opposed by natural resource management and review agencies.

In the 6 June 1986 letter from the Illinois Department of Conservation to the U.S. Fish and Wildlife Service, three potential disposal sites are specified. A map showing the sites (designated A, B, and C) is attached to the letter. Area A is north of Bob Bangert Park on the eastern shoreline of Middle Quincy Bay. This area, in addition to low areas in Bob Bangert Park itself, may be an acceptable disposal site to interested parties. Area B is part of an old channel just north of the Burlington-Northern Railroad embankment on the western side of Quinsippi Island and is described as supporting a low aquatic life population. Area C is in the Indian Grave Drainage District and would be similar in natural resource value and disposal use impact as the previously mentioned D5 site.

In addition to the disposal sites, the 6 June 1986 Illinois Department of Conservation letter also mentions the possibility of using the dredged material to create mounds of dirt throughout the study area that could provide high water refuge for wildlife displaced by high water. This would probably be an acceptable disposal alternative for all interested parties, but if the dredged material is silt or clay the technical problems of containing the material (which is usually about 90 percent water as it leaves the discharge pipe) may be prohibitive.

Lower and Middle Quincy Bay

Sedimentation in Lower Quincy Bay is not as severe as in other areas of the bay. Sedimentation surveys (table 2 and plate 11) have indicated a stable depth in recent years, such that recreational navigation has

rarely been affected. However, based on the dredging that has been performed to maintain the entrance to the Squaw Chute boat harbor (table 1) and the accretion of the shoreline, it is evident that some sedimentation is occurring in Lower Quincy Bay. Sedimentation in Middle Quincy Bay has all but curtailed recreational navigation to the upper portions of Quincy Bay.

An assured depth of 5 feet would be beneficial to the lower and middle bay fishery. This depth also could be optimum for some species, depending on water clarity and current. However, additional benefits could be achieved by dredging some areas to depths of 10 feet or more.

In the interest of recreational navigation, the River and Harbor Act of 1962 authorized the Corps of Engineers to perform maintenance dredging of Lower and Middle Quincy Bay. The area to be maintained at a 5-foot depth commences at the mouth of Quincy Bay proper, station 0+00, and extends upstream to station 90+00, as shown on plate 3. The channel width would be 300 feet, except at "The Narrows," where it would be reduced to some 200 feet.

Maintenance dredging of Lower and Middle Quincy Bay has not been performed in recent years due to lack of funding for recreation-based dredging. If funds become available, the Corps could dredge the 300-foot-wide channel through Lower and Middle Quincy Bay provided that the local sponsor obtains (a) suitable disposal site(s).

Since a modified or additional Corps' dredging project for Middle and/or Lower Quincy Bay would have more than 50 percent of the benefits attributable to recreational enhancement, pursuit of modifying the existing project authority or new project authority in Middle and/or Lower Quincy Bay was dropped from further consideration.

Upper Quincy Bay

This alternative plan would begin at the upper limit of the maintenance dredging in "The Narrows" and continue on up-bay, ending near the Rock Point Club (see plates 3 and 19). The width of the dredged area would widen from 200 feet at "The Narrows" to about 600 feet near the Rock Point Club. The area would be maintained to a 5-foot depth, similar to the depth maintained for Lower and Middle Quincy Bay access. The total dredging area for the alternative would be about 65 acres. As previously mentioned, the assured 5-foot depth would be beneficial to the fishery and, depending on water clarity, could even be optimal for some species. Additional benefits to the fishery could be obtained by dredging some areas to depths of 10 feet or more.

A majority of the material dredged from Upper Quincy Bay would be a very fine silty material which is unsuitable for construction purposes. Therefore, this dredged material would have to be disposed. The disposal sites identified assume that a containment levee would need to be constructed and that the placement of dredged material will be permanent.

Disposal Site 1 (designated D5 in the Fish and Wildife Service's Planning Aid Report and Area C in the Illinois DOC's letter), at the south end of the Indian Grave Drainage District (plate 19), has the capacity for approximately 1.7 million cubic yards of dredged material. Disposal Site 2 (adjacent to Area A in the Illinois DOC letter), in Bob Bangert Park (plate 19), has the capacity for about 60,000 cubic yards of dredged material. These two sites have the combined capacity for initial and maintenance dredging of Upper Quincy Bay for a period of about 50 years.

As previously mentioned, both sites probably would be acceptable to review agencies. However, Disposal Site 1 is currently an agricultural field with a potential to contain significant cultural resources. Before any site could be recommended for disposal, a cultural resources survey and assessment would be necessary and the results of this survey coordinated with the Illinois State Historic Preservation Officer. Also, Disposal Sites 1 and 2 are similar to those used for previous maintenance dredging disposal. Any future maintenance of existing Corps projects will be hampered or more costly due to a lack of adjacent disposal sites. Other disposal sites, originally proposed, are less desirable because of environmental impacts as noted by the Fish and Wildlife Service in their Planning Aid Report (Appendix B - Pertinent Correspondence).

A preliminary economic analysis of dredging Upper Quincy Bay is shown in table 5. Based on a benefit-to-cost ratio of 0.61, this alternative was dropped from further consideration.

TABLE 5

Preliminary Economic Analysis
Selective Dredging
Upper Quincy Bay

Total First Cost	$1,068,000
Annual Cost	96,200
Annual Maintenance Cost	21,200
Total Annual Cost	$ 117,400
Total Annual Benefits	71,400
Benefit-to-Cost Ratio	0.61

Access Channel

Under authority of Section 107 of the 1960 River and Harbor Act, the Corps of Engineers was authorized to construct and maintain a small-boat access channel across Bay Island (plate 5). This access channel runs through a

backwater area known as Broad Lake. The Corps performs maintenance dredging of this 50-foot-wide access channel as necessary, and the local sponsor provides suitable disposal site(s). Federal maintenance responsibility is dependent on availability of funding.

Broad Lake

Broad Lake (plate 2) has been used primarily as a fishing and hunting resource. If measures are not undertaken to reestablish the fishing and hunting potential in Broad Lake, its recreational value will be minimal. Hence, to enhance conditions at Broad Lake, it is assumed for planning purposes that it should be dredged to establish and maintain a 10-foot depth (plate 19). This depth would help to establish a healthy fishery and would provide a more than adequate depth for recreational craft.

The U.S. Fish and Wildife Service, in their Planning Aid Report (appendix B), also has recommended that selected sloughs be dredged to a 10-foot depth in their centers for hunter access, but leaving the shoreline areas with moderate slopes to maximize duck habitat.

Since a high percentage of the sediment in Broad Lake is bedload sand, it would be most cost-effective if this dredged material could be disposed of in such a manner as to construct a structural barrier to Mississippi River flood flows. Consequently, a plan was developed using the material dredged from Broad Lake to construct a levee between Quincy Bay and the main channel of the Mississippi River. Therefore, to promote feasibility, analysis of the dredging of Broad Lake has been combined with a Mississippi levee alternative which is evaluated in the following paragraphs.

Sedimentation Reduction Measures

The following measures were considered to reduce the present rate of sedimentation in Quincy Bay. However, with the "no action" condition of leaving many areas of the bay inaccessible, the following plans will not improve upon the existing condition if not combined with one of the aforementioned dredging plans. If the following plans do not include some selective dredging, then they should only be considered as additional measures to reduce the present rate of sedimentation, thereby reducing the frequency of maintenance dredging necessary to maintain the bay in an acceptable condition.

Access Channel Restriction

Since initial dredging, the upper end of the access channel has scoured to a much larger cross-sectional area than originally designed, as shown on plate 12. This larger cross-sectional area carries a relatively large

sediment load into Broad Lake and portions of Lower and Middle Quincy Bay. According to the State Water Survey in their Investigation of Sedimentation in Quincy Bay, approximately 22 percent of the bay sediment is attributable to flow through the access channel. Modification of the access channel to its original design cross section could reduce the sediment load through the channel while allowing recreational craft to pass. This alternative is intended to prevent Mississippi River bedload sand from entering the access channel and to cause the sand to bypass the access channel. The alternative requires the construction of a submerged weir section to be built across the scoured access channel. See plates 20 and 21 for project location and plan and profile drawings, respectively.

It is estimated that construction of a submerged weir in the access channel will decrease the present sand flowing down the access channel by 50 percent. At the present time, most of the sand flowing down the access channel is being deposited in Broad Lake. However, as Broad Lake fills in, more of the sand flowing down the access channel will be deposited in Middle and Lower Quincy Bay.

The U.S. Fish and Wildlife Service, in their Planning Aid Report (appendix B) has indicated support for this alternative.

A preliminary economic analysis of this alternative is shown in table 6. With a benefit-to-cost ratio of 1.09, this alternative could possibly be recommended for further consideration as a modification to an existing project under existing operation and maintenance authority per ER 1165-2-119, dated 20 September 1982.

TABLE 6

Preliminary Economic Analysis
Sedimentation Reduction
Access Channel Restriction

Total First Cost	$207,000
Annual Cost	18,600
Annual Maintenance	5,000
Total Annual Cost	$23,600
Total Annual Benefits	$25,800
Benefit-To-Cost Ratio	1.09

Closing of the Access Channel

Closing the access channel would eliminate all of the sediment currently flowing through the access channel. This alternative would eliminate the present upstream recreational boat access between the Mississippi River and Quincy Bay. Since this access channel is an authorized project, congressional approval would be required to deauthorize the project. It is estimated that the cost to close the access channel is about the same as the cost for the access channel restriction.

Mississippi River Levee

During high flows on the Mississippi River, most of the Quincy Bay area is flooded. The floodwater flowing into Quincy Bay area is slowed due to the interconnecting sloughs, islands, and vegetation. This reduction in flow velocity causes some of the Mississippi River sediment load to be deposited in the Quincy Bay area. A cross section taken at river mile 330 in 1938 and again in 1978 shows that certain areas of Quincy Bay have shallowed by as much as 2 feet over the 40-year period due to sedimentation (see plate 10). The Illinois State Water Survey estimated that approximately 70 percent of the sediment in Quincy Bay is attributable to flooding on the Mississippi River.

To reduce the Mississippi River sediment load that is presently being deposited during floods in Quincy Bay, a levee extending from the Indian Grave Drainage District Levee to the Burlington Northern Railroad embankment could be constructed (alignment as shown on plate 20). This levee would not prevent the area from backwater flooding, but it would reduce sediment deposition caused by flood flows through the area.

During high flow periods it is estimated that the water level on the river side of the levee will be about a foot higher than the level on the land side, as shown on table 7. The two primary design considerations would be the velocity adjacent to the levee on the river side and on the land side when the levee is overtopped.

As previously mentioned, the levee could be constructed of material dredged from Broad Lake. This would create a 31-acre recreational fishery in Broad Lake (plate 19) which would need to be maintained. The construction of this levee also would necessitate deauthorization and permanent closure of the access channel project.

TABLE 7

Mississippi River Water Surface
Elevations Adjacent to Quincy Bay

Flood Frequency (Year)	Water Surface Elevations River Mile 327 [1]	River Mile 328 [2]	River Mile 329	River Mile 330 [3]
1	470.7	471.05	471.4	471.75
2	475.8	476.15	476.5	476.85
5	479.3	479.65	480.0	480.35
10	481.2	481.55	481.9	482.25
25	483.7	484.05	484.4	484.75
50	485.4	485.75	486.1	486.45
100	486.5	486.85	487.2	487.55
200	488.1	488.45	488.8	489.15
500	489.8	490.15	490.5	490.85

[1] The mouth of Quincy Bay is at river mile 327.3.

[2] The new Burlington Northern Railroad Bridge and embankment are at river mile 328.

[3] Southwest corner of Indian Grave Drainage District Levee is at river mile 330.

The U.S. Fish and Wildlife Service and the Illinois Department of Conservation are both supportive of efforts to improve or rehabilitate natural resource values of the Quincy Bay study area. However, both agencies in their correspondence (i.e., Fish and Wildlife Service's Planning Aid Report, dated 24 April 1986, and Illinois Department of Conservation letter, dated 2 June 1986; Appendix B - Pertinent Correspondence) caution that in addition to the acknowledged benefits of reducing sedimentation caused by floodwater, this alternative also has the potential for substantial environmental impact. The river otter, a species considered "threatened" by the State of Illinois, is known to occur in the study area. The proposed levee may restrict "access to" or travel of the species in the area. The levee would fill aquatic habitat, a resource most in need of salvation in the area, and require the clearing of many trees which might serve as eagle perches or mild weather night roosts.

A cultural resources survey and assessment of the proposed levee alignment and any borrow location would be necessary if this alternative is pursued.

A preliminary economic analysis of this levee constructed to a 50-year flood level (determined to be an optimal level) is shown in table 8. Based on a benefit-to-cost ratio of 0.15, this alternative was dropped from further consideration.

TABLE 8

Preliminary Economic Analysis
Sedimentation Reduction
Mississippi River Levee

Total First Cost	$2,537,000
Annual Cost	228,400
Annual Maintenance Cost	21,500
Total Annual Cost	$ 249,900
Total Annual Benefits	$ 37,200
Benefit-to-Cost Ratio	0.15

Canton Chute Access Channel

A channel from Canton Chute into Willow Slough (see plate 2 for general location) would bring Mississippi River flows into the upper reaches of the bay and would increase water velocities through much of the bay. However, this channel also would introduce sediment into the upper end of the bay and could cause additional sedimentation similar to that caused by construction of the access channel. Depending on the design, such a channel would have to be dredged for a length of 2,500 to 5,000 linear feet and would be subject to both scour and deposition. Based on these potential adverse impacts, the Canton Chute access channel is not recommended for further consideration.

Modifications of Triangle Lake

Dredging Triangle Lake (plate 20) would return the lake to a useful depth and provide additional volume to trap sediment from Frazier-Homan Creek and outflow from the Indian Grave Drainage District. It is estimated that this measure would be effective for trapping and storing sediment for perhaps 15 to 30 years before additional dredging would be required.

Constructing an outlet control and raising the levees around Triangle Lake would raise the water level in Triangle Lake, thereby returning it to a useful depth, providing more space to trap sediment from Frazier-Homan Creek.

With only 8 percent of the total bay sediment attributable to flows emanating from Triangle Lake, any measure involving Triangle Lake would not have a significant effect on reducing the overall sedimentation rate

in the bay. This is especially true for Upper Quincy Bay, where sedimentation is mostly attributable to Mississippi River backwater or other small tributary flows. Hence, this alternative and all other modifications considered for Triangle Lake were dropped from further consideration.

Boat Harbor Expansion

The best location to increase the small-boat docking facilities is immediately north of the existing Squaw Chute Marina (plate 22). The length of a harbor in this location is limited to about 900 feet. However, the width of the harbor can easily be increased or decreased depending on the size of harbor desired.

The harbor expansion plan consists of a harbor 900 feet long and 200 feet wide, for a total area of 180,000 square feet. This plan provides for an access and maneuvering channel 50 feet wide and an area 900 feet long by 150 feet wide for docking facilities. A typical section through the proposed harbor is shown on plate 23.

Acceptable disposal sites for the harbor expansion plan would be the same as those identified for the selective dredging alternatives, as shown on plate 19.

The proposed harbor site is an area of submergent and emergent aquatic vegetation and provides essential habitat requirements for shorebirds, waterfowl, and fish. The U.S. Fish and Wildlife Service, in their Planning Aid Report (appendix B) suggests that mainland sites be considered before a final harbor site selection is made and that Habitat Evaluation Procedures (a quantitative methodology) be employed to analyze alternative sites.

The proposed harbor area is recently accreted land with arrowhead and cottonwoods the predominant vegetation. The actual dredging and construction of the harbor expansion plan would have no effect on cultural resources; however, a cultural resources survey and assessment would be necessary for any selected disposal site.

A preliminary economic analysis of the harbor expansion project is revealed in table 9. Based on a benefit-to-cost ratio of 0.24, this alternative was dropped from further consideration.

TABLE 9

Preliminary Economic Analysis
Boat Harbor Expansion

Total First Cost	$798,000
Annual Cost	71,800
Annual Operation and Maintenance Cost	3,500
Total Annual Cost	$ 75,300
Total Annual Benefits	$ 17,800
Benefit-to-Cost Ratio	0.24

No Additional Federal Action

Under this alternative, no additional Federal action would be initiated to change the existing processes of water circulation and sediment scour or deposition. Recreational boating, hunting, and fishing will decrease with continued sedimentation. The bay area will shift more to terrestrial and wetland habitats and away from aquatic habitats. The access channel and bay outlet will continue to have significant water and sediment discharges passing through them and will attain a relatively stable, or dynamic, equilibrium condition in the near future.

The Illinois Water Survey's 1985-1986 study shows that in the past few years and at the present time 53,900 tons of basically sand is being transported down the Upper Quincy Bay access channel annually. This material is and has been deposited in lower Broad Lake. As lower Broad Lake is silted in, the flow down the access channel should be reduced, thus decreasing the sediment load being transported down the channel. It is possible that lower Broad Lake could completely silt in, thereby blocking flows through the access channel during Mississippi River flat pool periods. If the upper access channel is maintained after lower Broad Lake is silted in, the silt load would be transported to Middle and Lower Quincy Bay. In order to properly evaluate the economics of the different alternatives to reduce the access channel siltation, the future rate of siltation must be determined. The present rate of 28 acre-feet of basically sand probably will continue until Lower Broad Lake is silted in.

The main questions to be answered are: (1) how desirable or valuable is the upper access channel, and (2) what happens if nothing is done in the near future. In addition, it must be decided whether lower Broad Lake, which is practically filled in now, is a proper tradeoff for the access channel siltation problem.

CONCLUSION

Sedimentation problems exist in Quincy Bay. This report identified alternative plans to improve the recreational potential, enhance the environmental quality, and reduce the present rate of sedimentation in the bay. The results presented in this report indicate that the upper Quincy Bay access channel might close itself off in the future. If the channel is to be kept open, an access channel restriction project may be feasible. An access channel restriction project may be subject to cost-sharing with the local sponsor.

The Quincy Park District could investigate the possibility of implementing plans analyzed in this report. Those additional plans which could prove to be most favorable include: Squaw Chute - Boat Harbor Expansion; Dredging Upper Quincy Bay; and Dredging Broad Lake.

In response to natural resource concerns, the U.S. Fish and Wildlife Service has provided a Planning Aid Report, dated 24 April 1986, and the Illinois Department of Conservation has provided two letters, one dated 2 June 1986 and one dated 6 June 1986. All three of these documents may be found in Appendix B - Pertinent Correspondence.

SECTION 3 - SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

During the Reconnaissance Study, various Federal, State, and local agencies were contacted for planning review and comment. Pertinent correspondence from these contacts is included in appendix B.

In a letter dated 20 February 1986, the Illinois State Historic Preservation Officer requested that an archeological reconnaissance survey be conducted to determine if any significant cultural resources are present in the area to be impacted by a proposed project. This action is required by the National Historic Preservation Act, as amended in 1980, Executive Order 11593, and various other environmental laws.

SECTION 4 - RECOMMENDATION

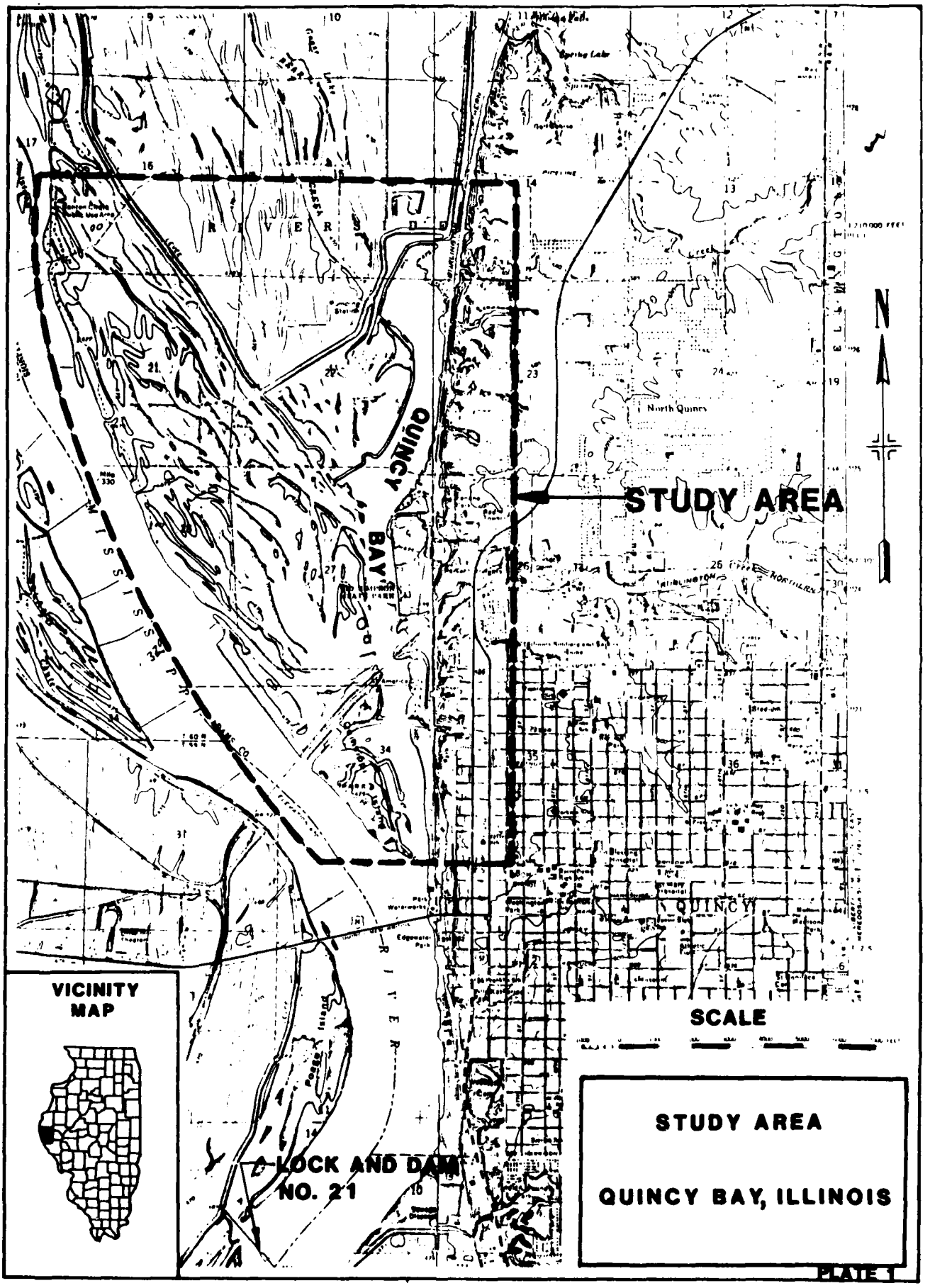
Based on the preliminary analysis and evaluation of alternative plans presented in this report, I recommend that no further Federal action be taken under the 1980 authority for this report.

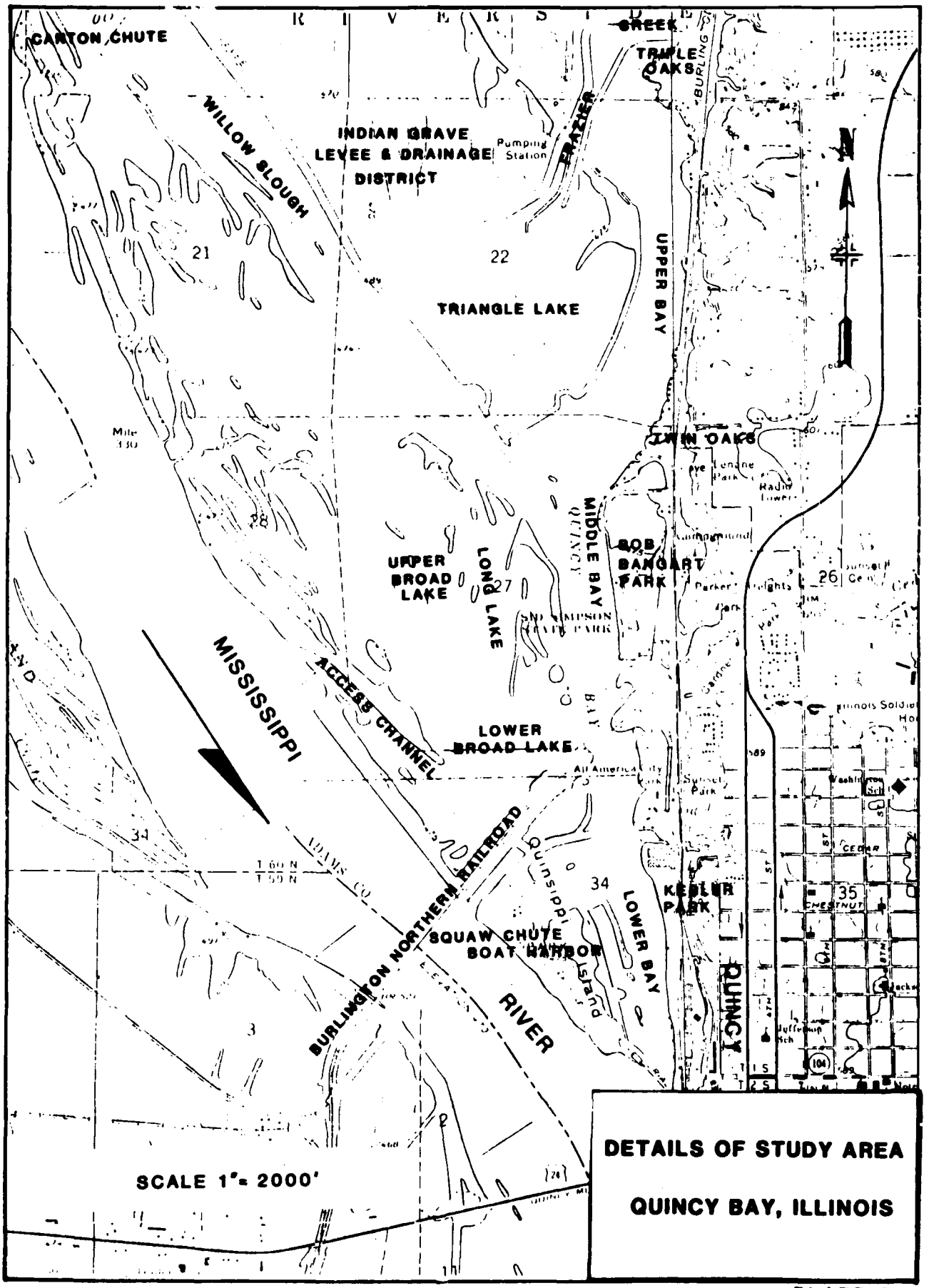
Neil A. Smart
Colonel, U.S. Army
District Engineer

REFERENCES

Investigation of Sedimentation in Quincy Bay, State Water Survey Division, Illinois Institute of Natural Resources, October 1986.

Recreational Use Associated With Quincy Bay, Huff and Huff, Inc., February 1986.

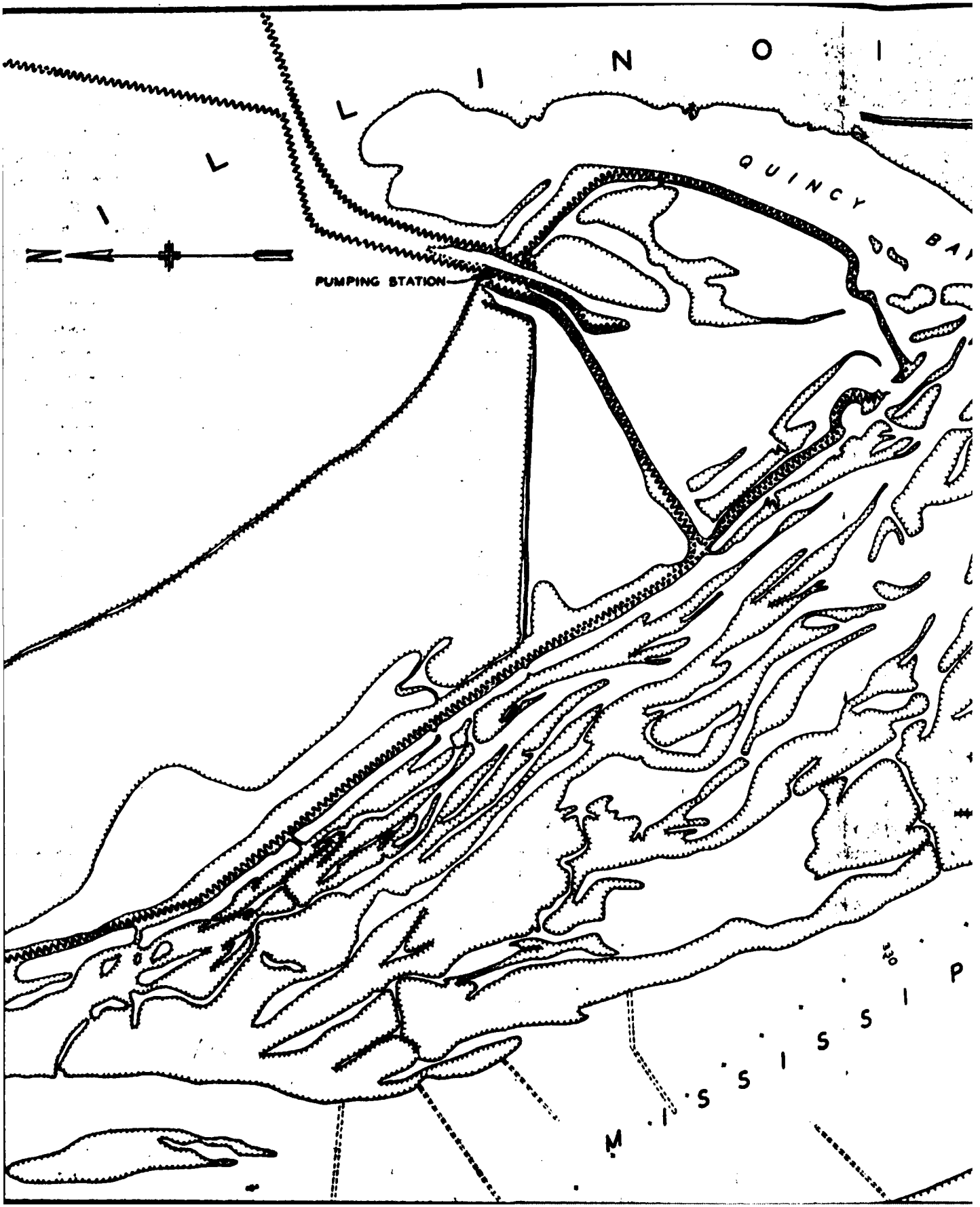

STUDY AREA
QUINCY BAY
QUINCY
N
SCALE
VICINITY MAP
LOCK AND DAM NO. 21
STUDY AREA
QUINCY BAY, ILLINOIS
PLATE 1

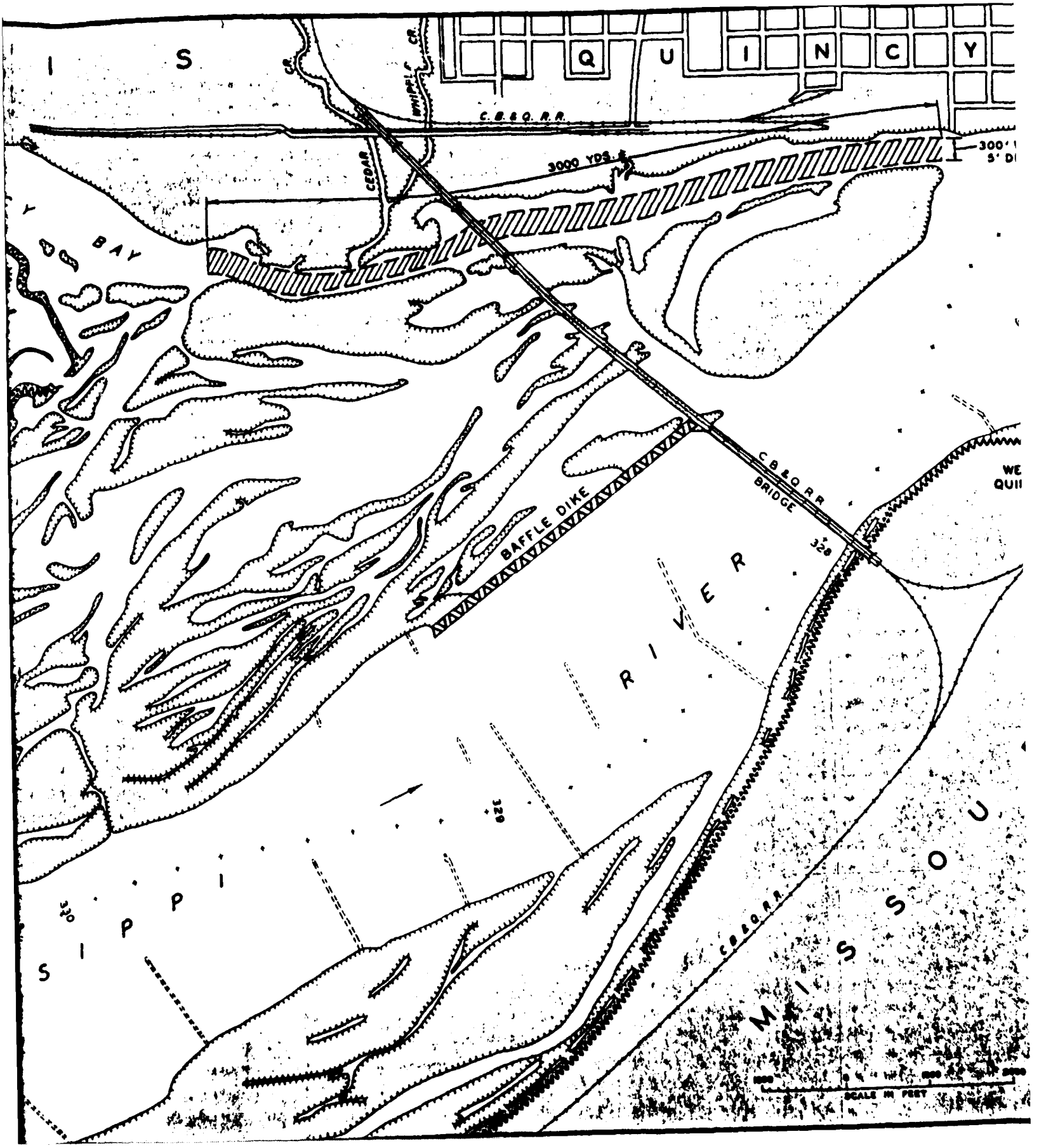


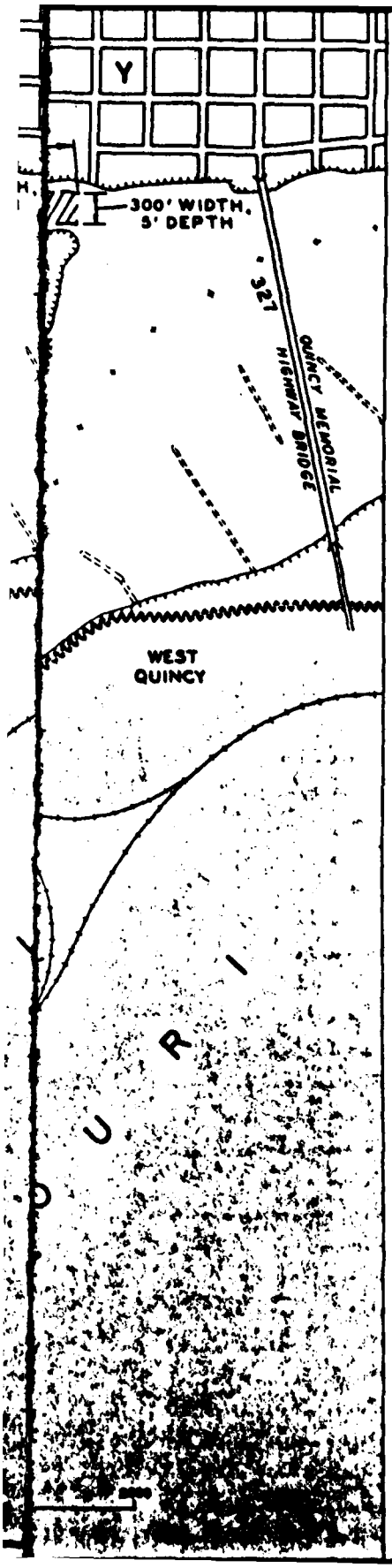
DETAILS OF STUDY AREA

QUINCY BAY, ILLINOIS

PLATE 2


I L L I N O I
QUINCY BA
PUMPING STATION
N
M I S S I S S I P P


I S
Q U I N C Y
WHIPPLE CR.
C.B.&Q.R.R.
3000 YDS.
CEDAR
BAY
C.B.&Q. RR BRIDGE
BAFFLE DIKE
328
R I V E R
S I P P I
330
C.B.&Q.R.R.
M I S S O U
SCALE IN FEET



VICINITY MAP

25 0 25 50 75
SCALE IN MILES

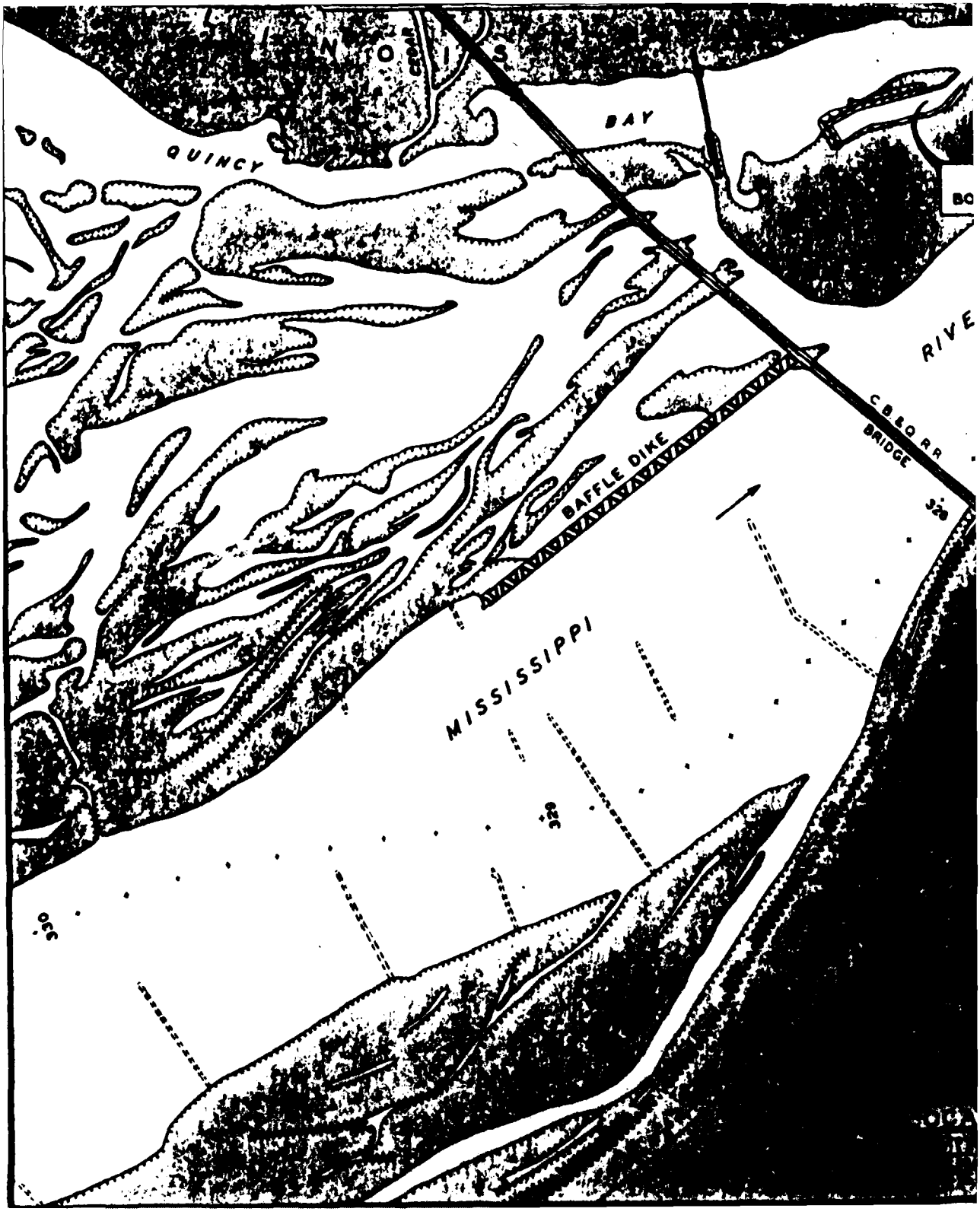
LEGEND

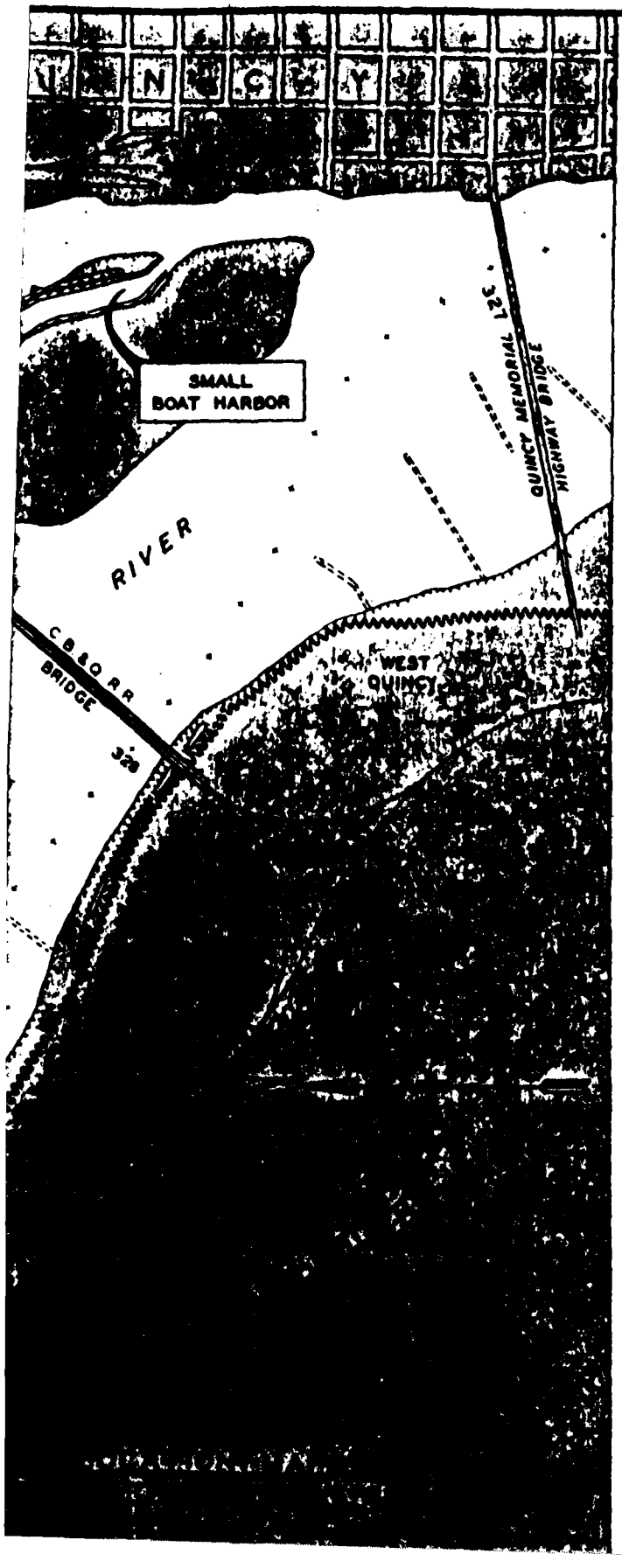
MAINTENANCE DREDGING

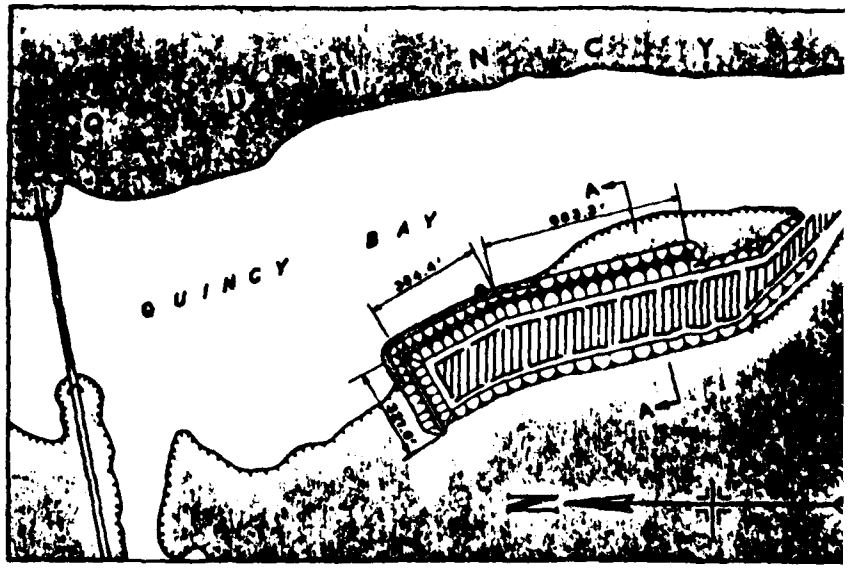
NOTE

MILEAGE ORIGINATES AT MOUTH OF OHIO RIVER

MISSISSIPPI RIVER
RIVER AND HARBOR PROJECT
QUINCY, ILLINOIS
SMALL BOAT HARBOR
SCALES AS SHOWN
ROCK ISLAND DISTRICT
30 JUNE 1963


ILLINOIS
CREEK
BAY
QUINCY
RIVE
C.B.&Q. R.R.
BRIDGE
BAFFLE DIKE
MISSISSIPPI
330
330

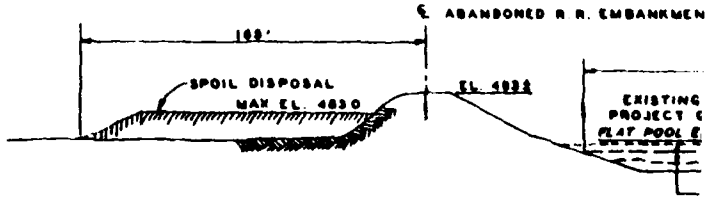




PLAN

500 0 500 100

SCALE IN FEET



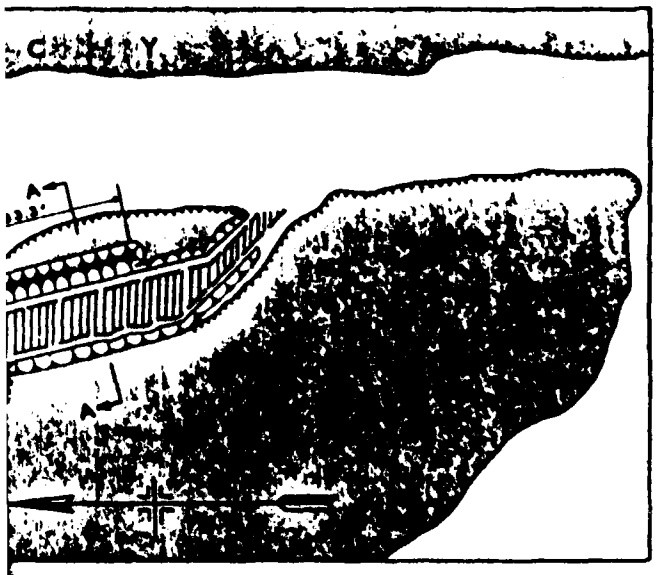
100

LEGEND

DREDGING

MILEAG
OF OHI

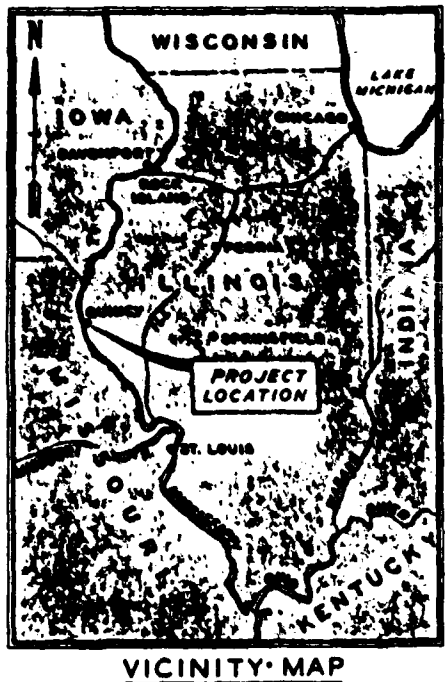
ELEVAT
LEVEL



PLAN

500 1000

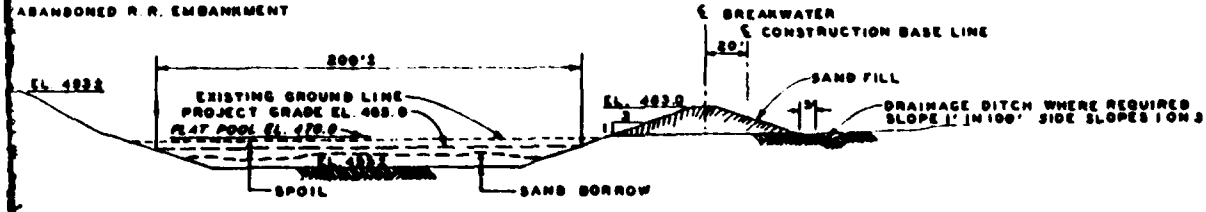
SCALE IN FEET



VICINITY MAP

25 0 25 50 75

SCALE IN MILES



SECTION A-A

100 50 0 100

SCALE IN FEET

MILEAGE ORIGINATES AT MOUTH OF OHIO RIVER

ELEVATIONS BASED ON MEAN SEA LEVEL DATUM (1912 ADJUSTMENT)

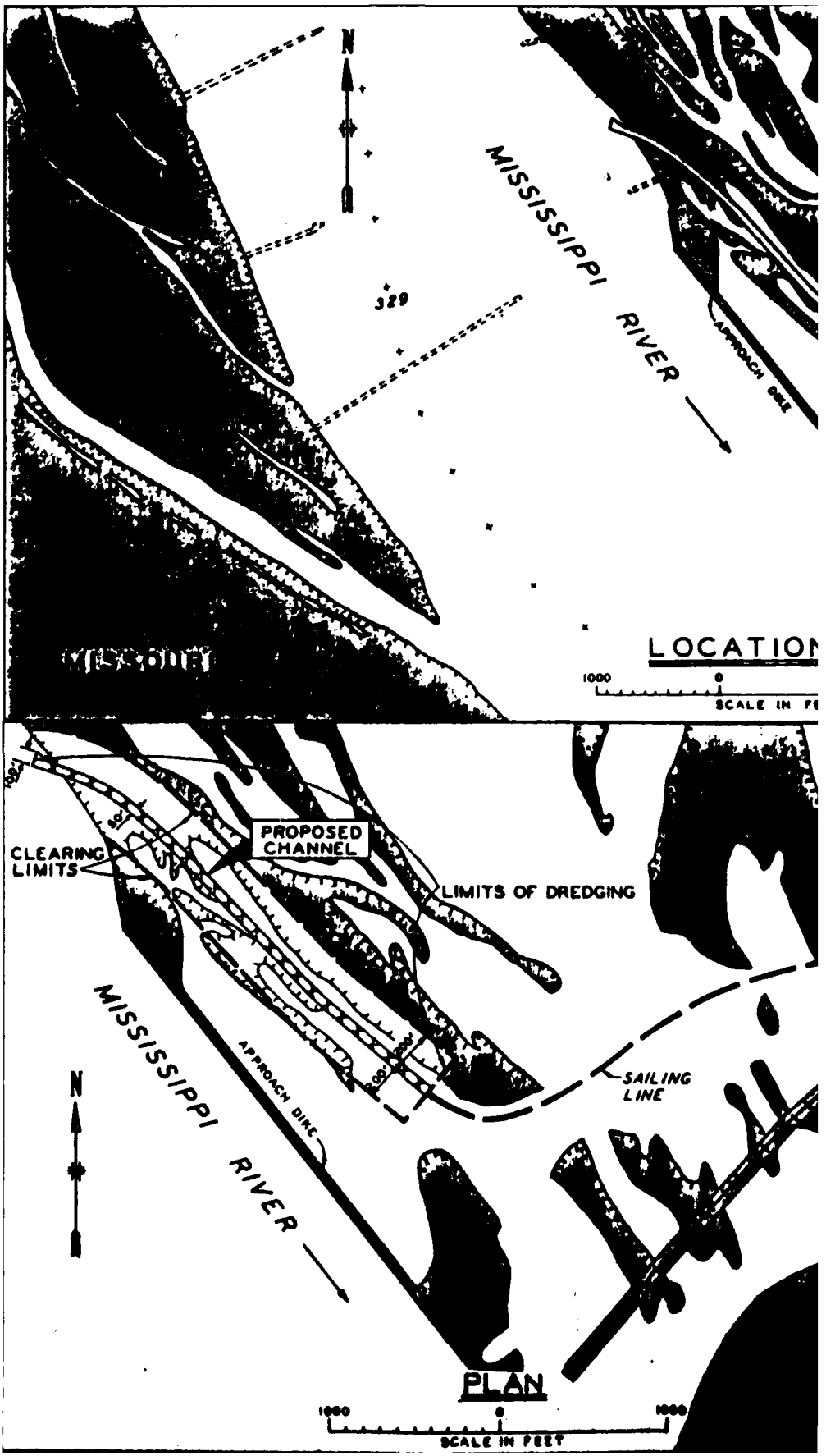
MISSISSIPPI RIVER
RIVER AND HARBOR PROJECT
SQUAW CHUTE – QUINCY, ILLINOIS

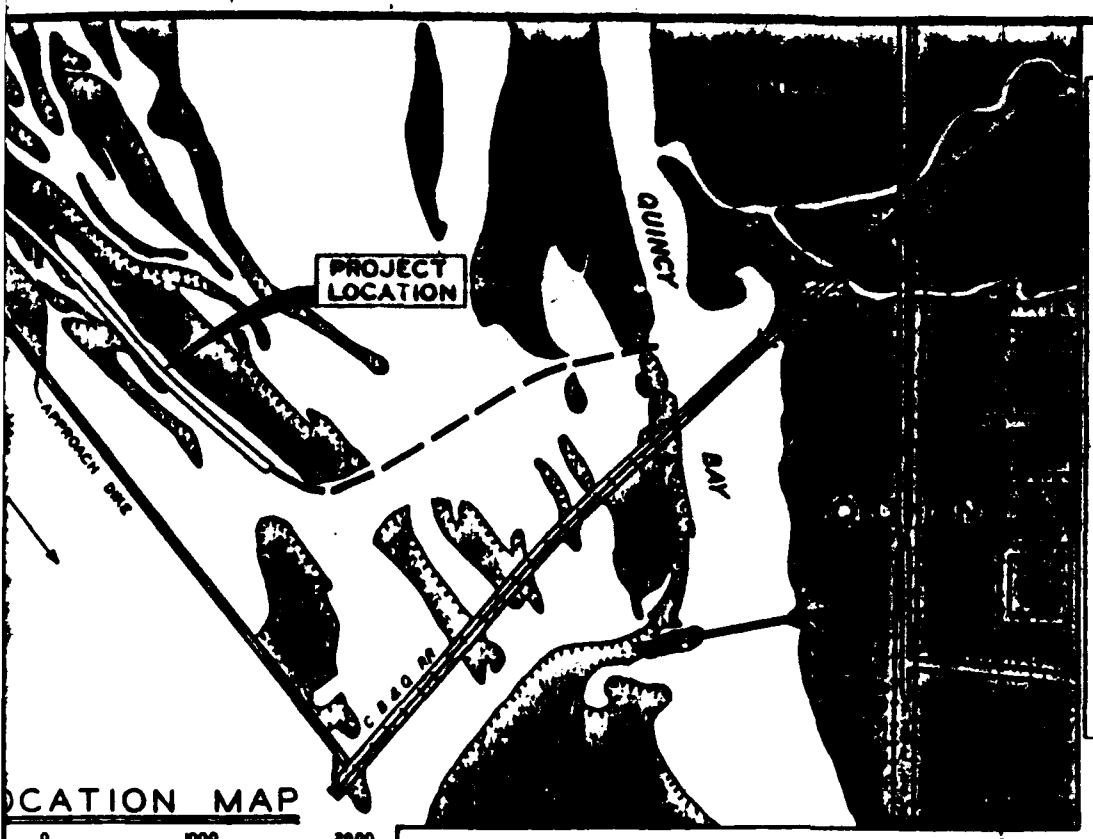
SMALL BOAT HARBOR

SCALES AS SHOWN

ROCK ISLAND DISTRICT

30 JUNE 1966

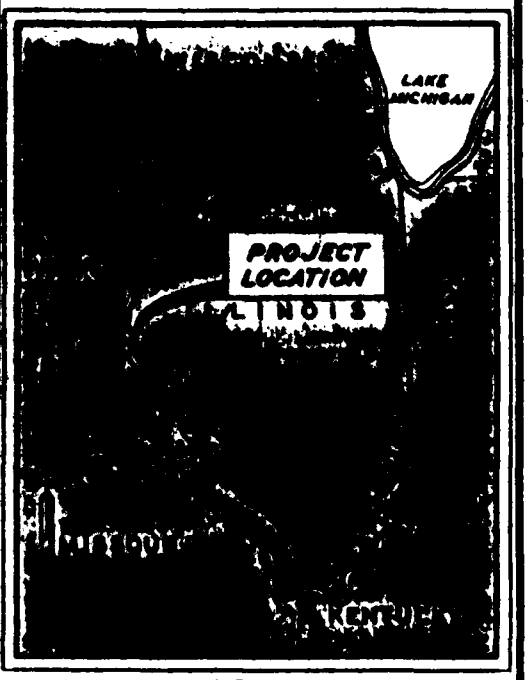

N
MISSISSIPPI RIVER
329
APPROACH DIKE
LOCATION
1000
0
SCALE IN FEET
PROPOSED CHANNEL
CLEARING LIMITS
LIMITS OF DREDGING
MISSISSIPPI RIVER
APPROACH DIKE
SAILING LINE
N
PLAN
1000
0
1000
SCALE IN FEET



OCATION MAP

0 1000 2000

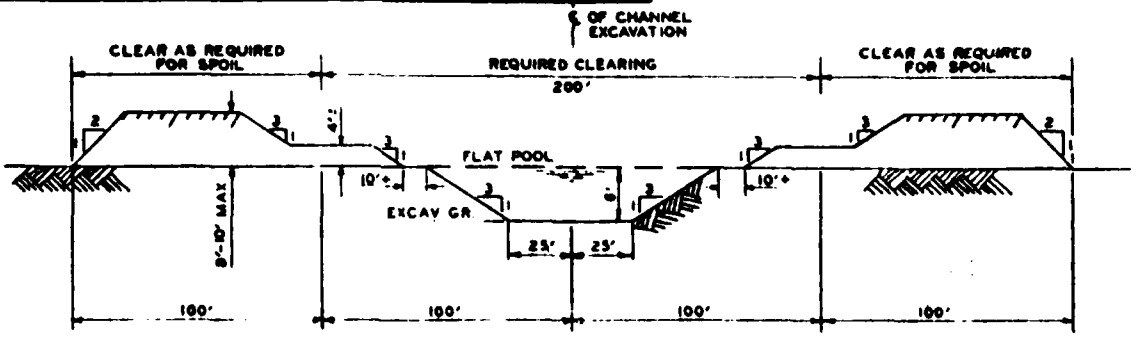
SCALE IN FEET



VICINITY MAP

25 0 25 50 75

SCALE IN MILES



TYPICAL CHANNEL SECTION

NO SCALE

NOTE:

1 RIVER MILEAGE REFERS TO THE DISTANCE ABOVE MOUTH OF THE OHIO RIVER

MISSISSIPPI RIVER

RIVER AND HARBOR PROJECT

QUINCY, ILLINOIS

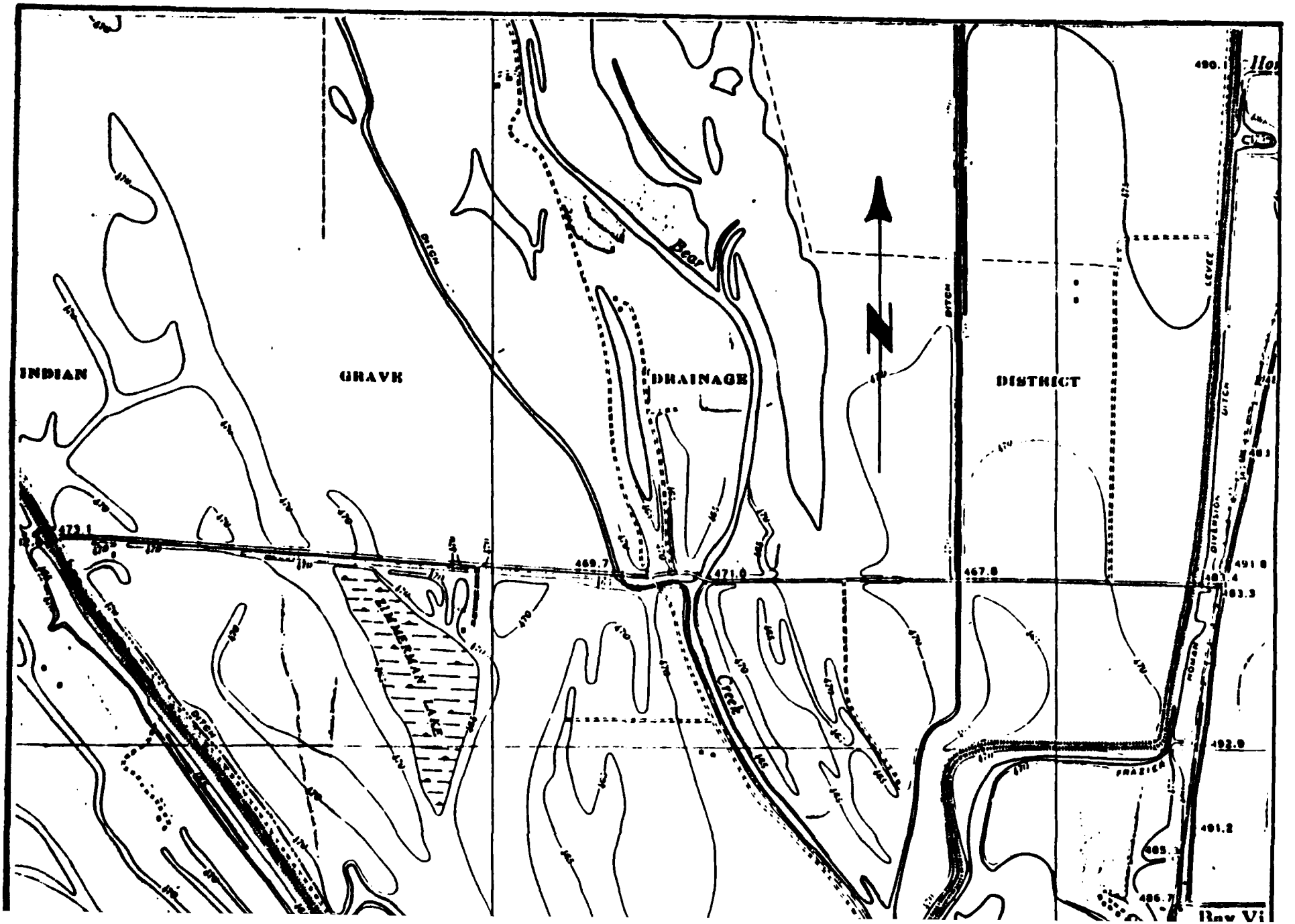
HARBOR ACCESS CHANNEL

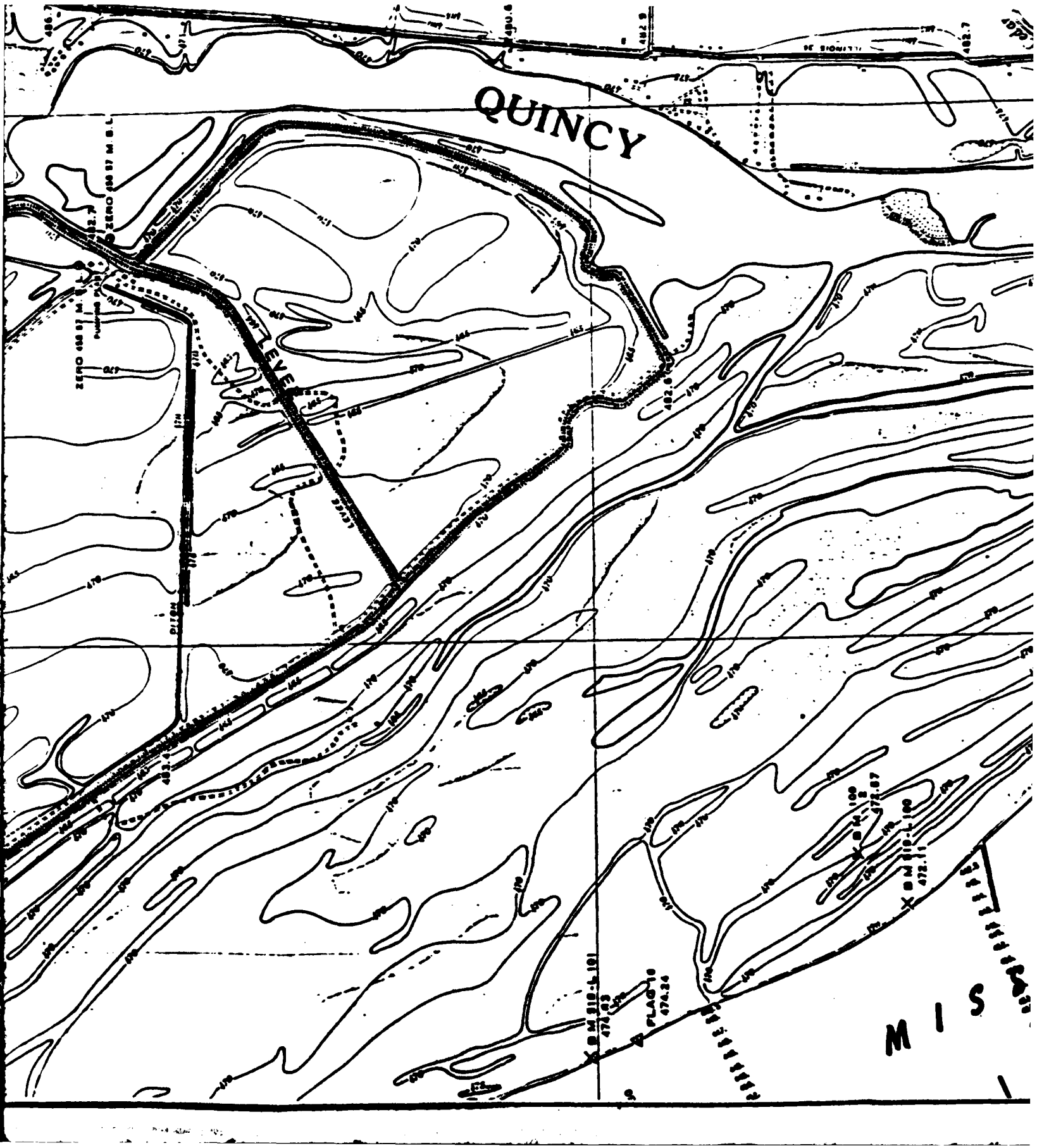
SCALES AS SHOWN

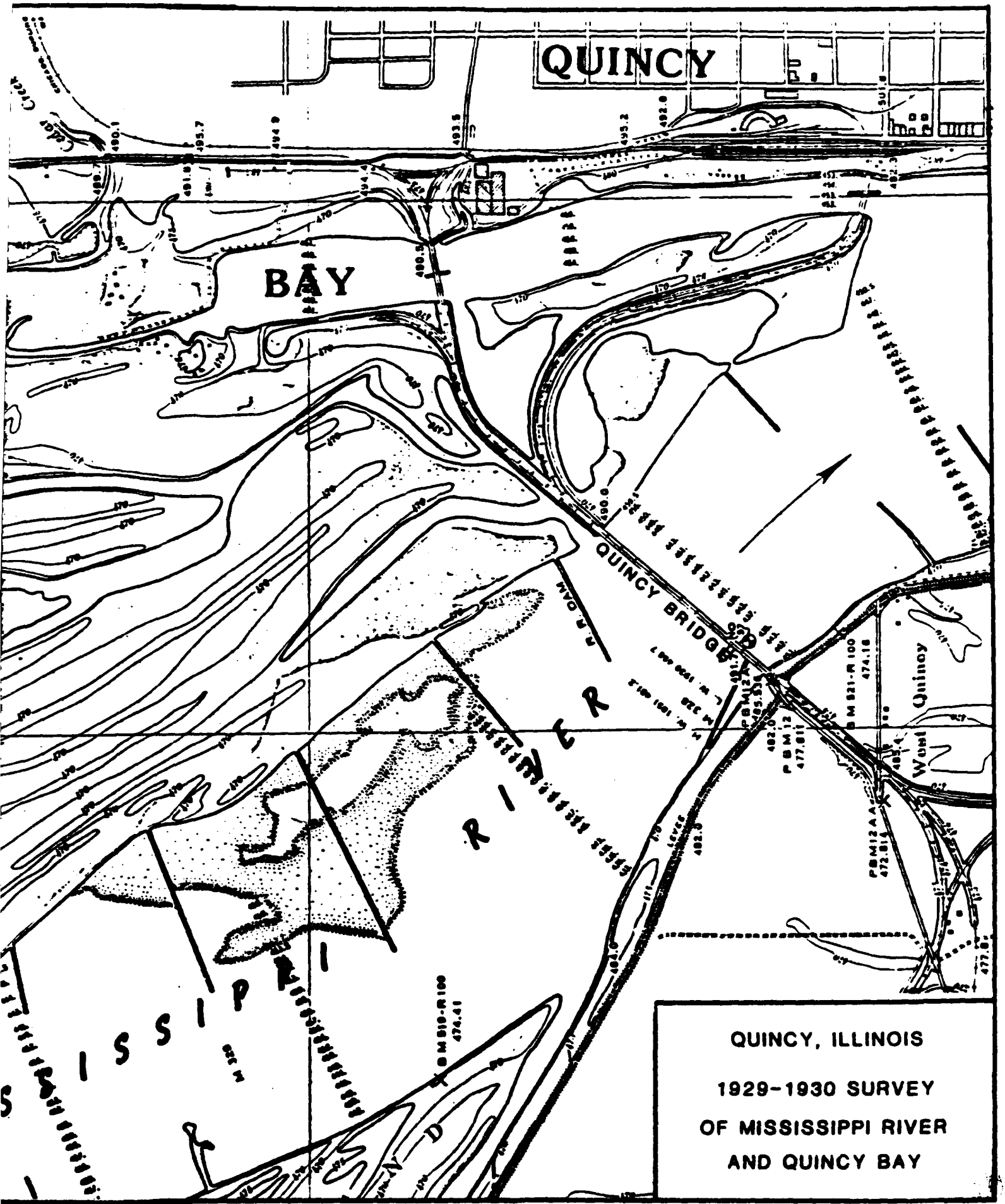
ROCK ISLAND DISTRICT

30 JUNE 1960

PLATE 5


INDIAN
GRAVE
DRAINAGE
DISTRICT
Reef
DITCH
LEVEE
DIVERSION
ROAD
FRAZIER
Creek
ZIMMERMAN
LAKE
472.1
469.7
471.0
467.8
491.8
493.3
492.0
491.2
485.
486.7


QUINCY
LEVEE
MIS



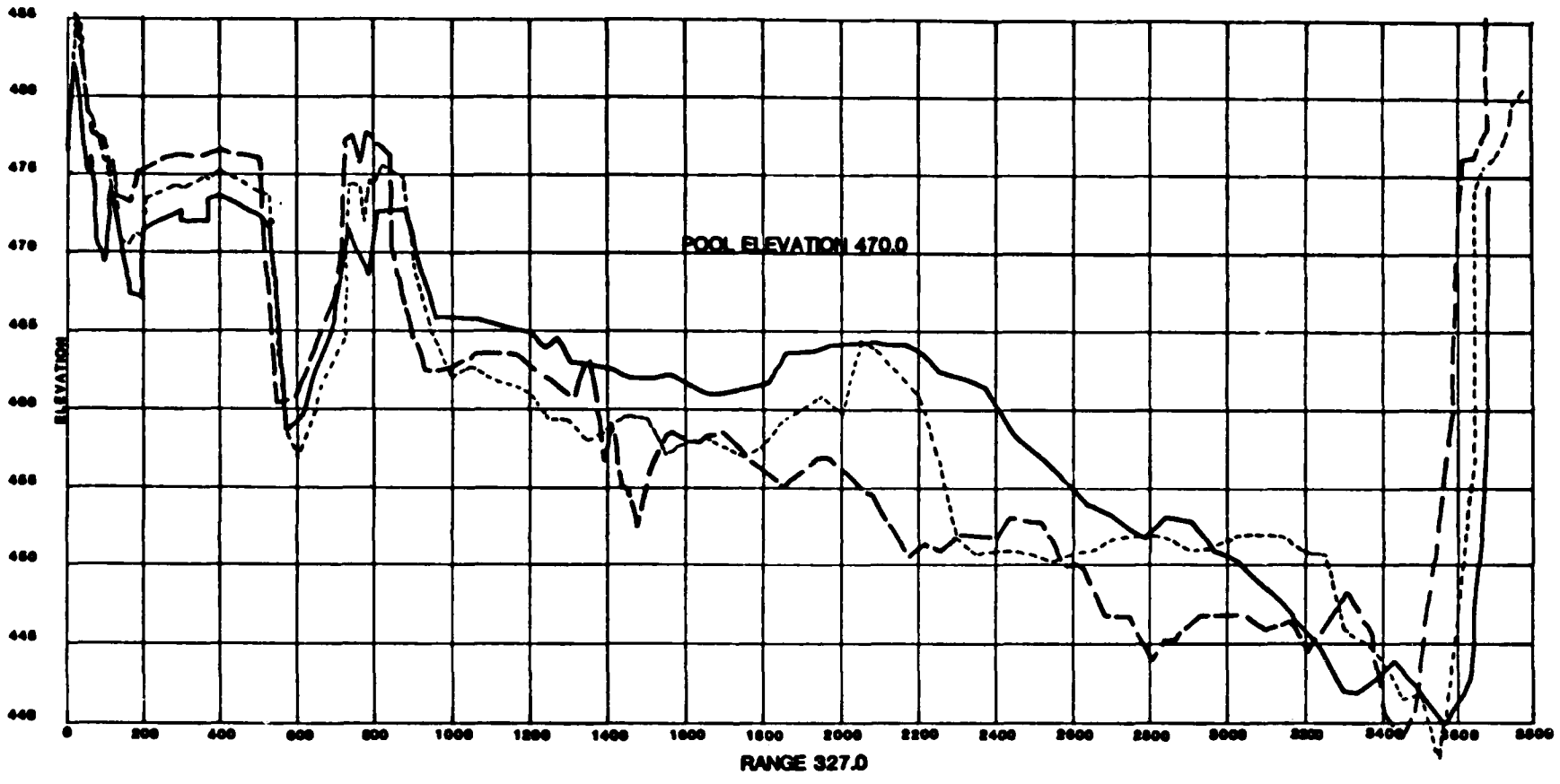
QUINCY, ILLINOIS

1929-1930 SURVEY

OF MISSISSIPPI RIVER

AND QUINCY BAY

PLATE 6



LEGEND:

——— 1938

------- 1953

— — 1978

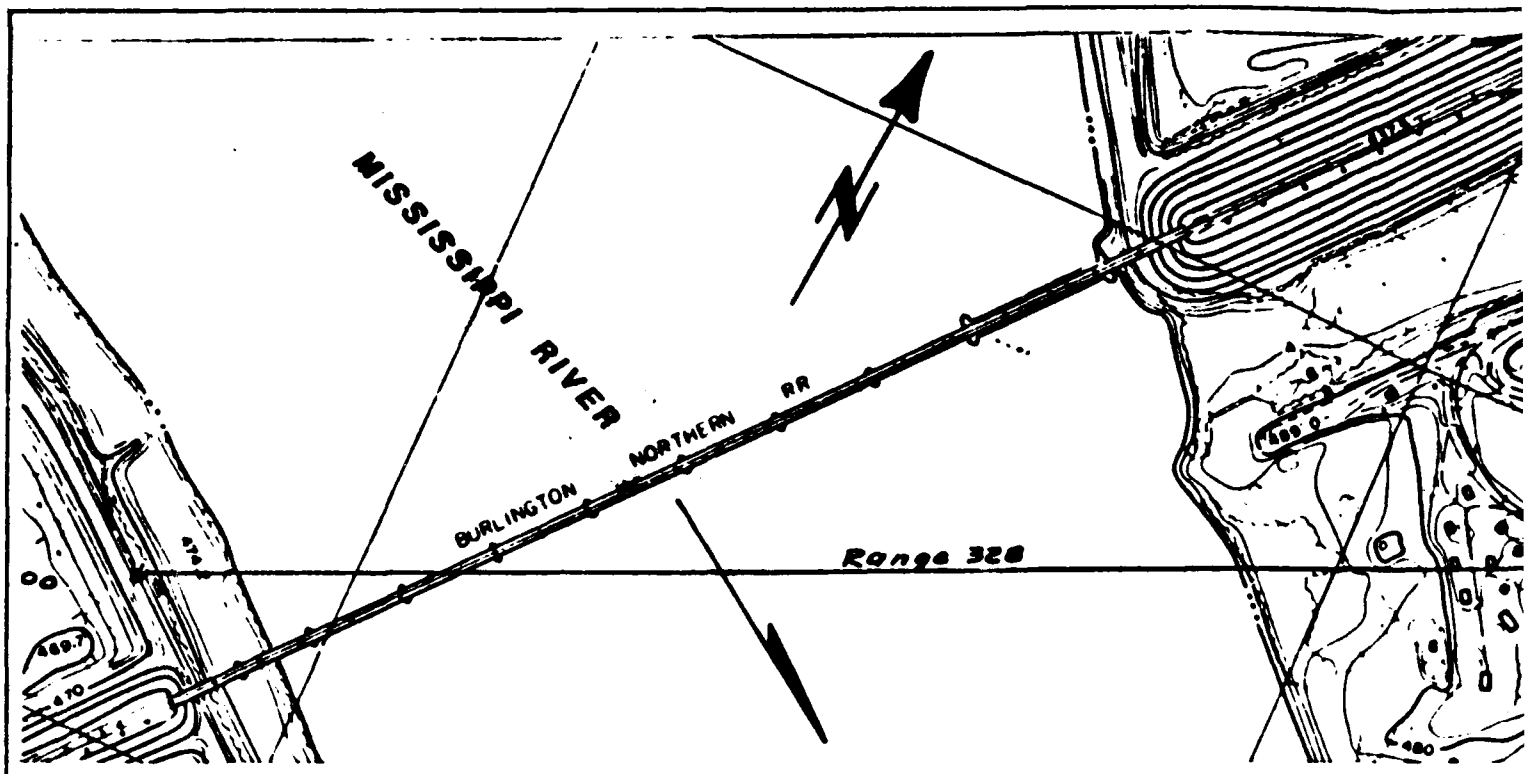
QUINCY, ILLINOIS

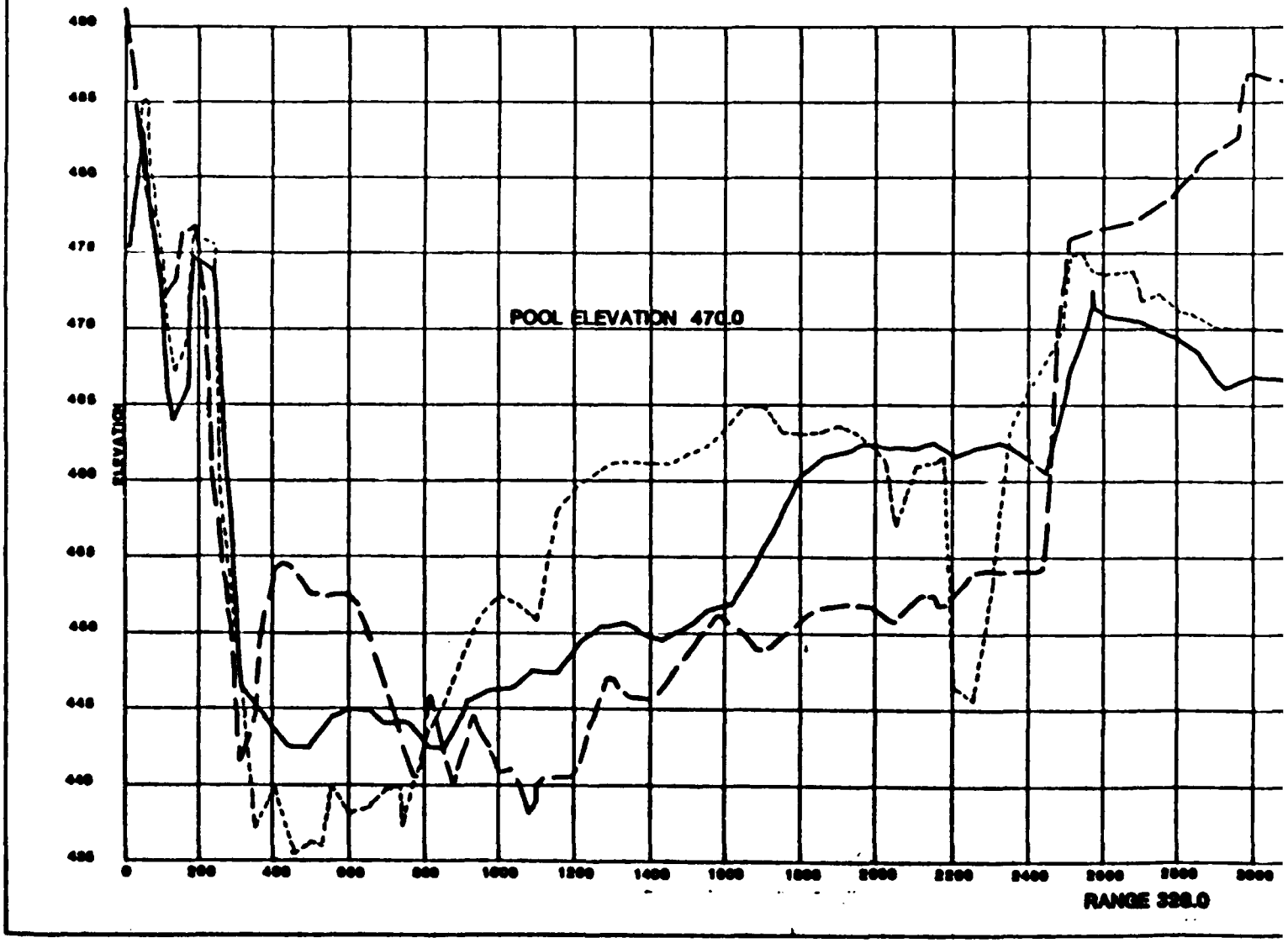
MISSISSIPPI RIVER PROFILE

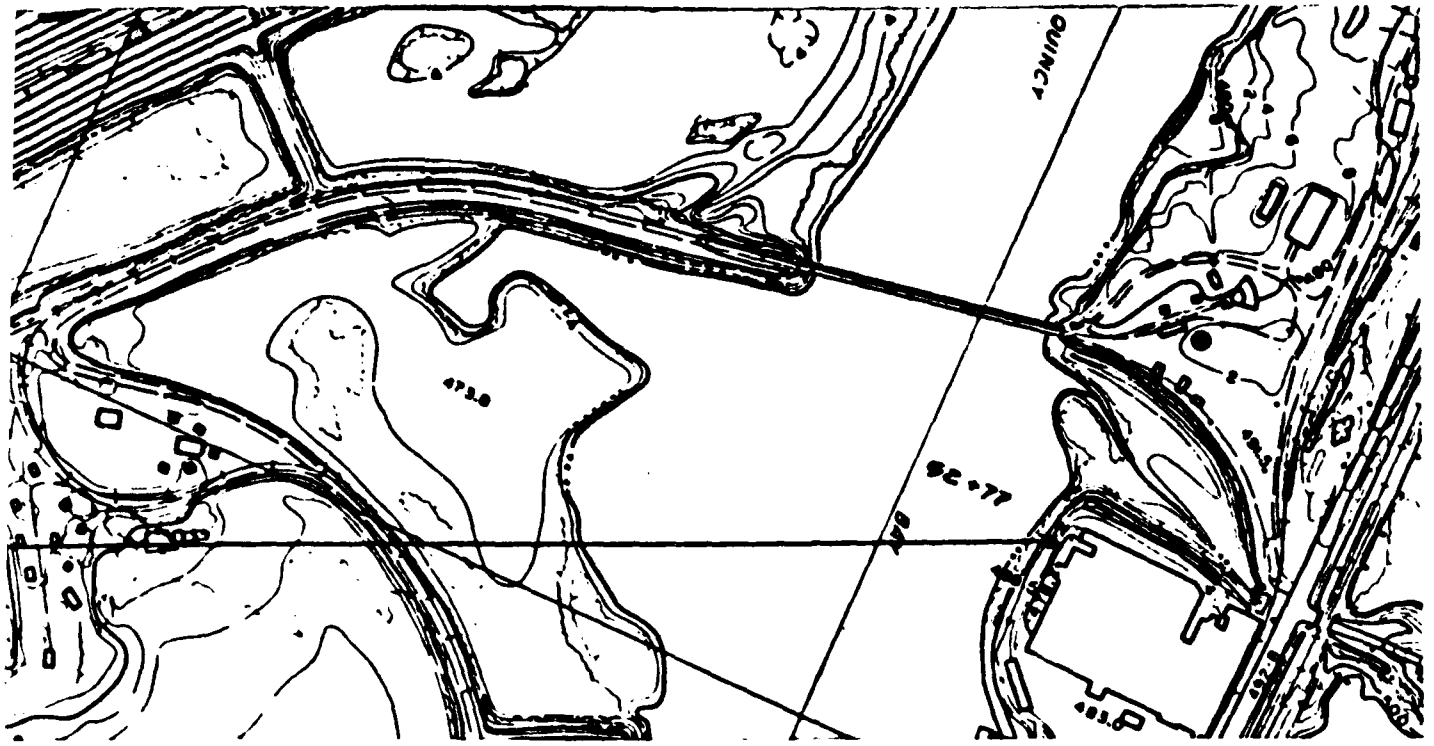
AT

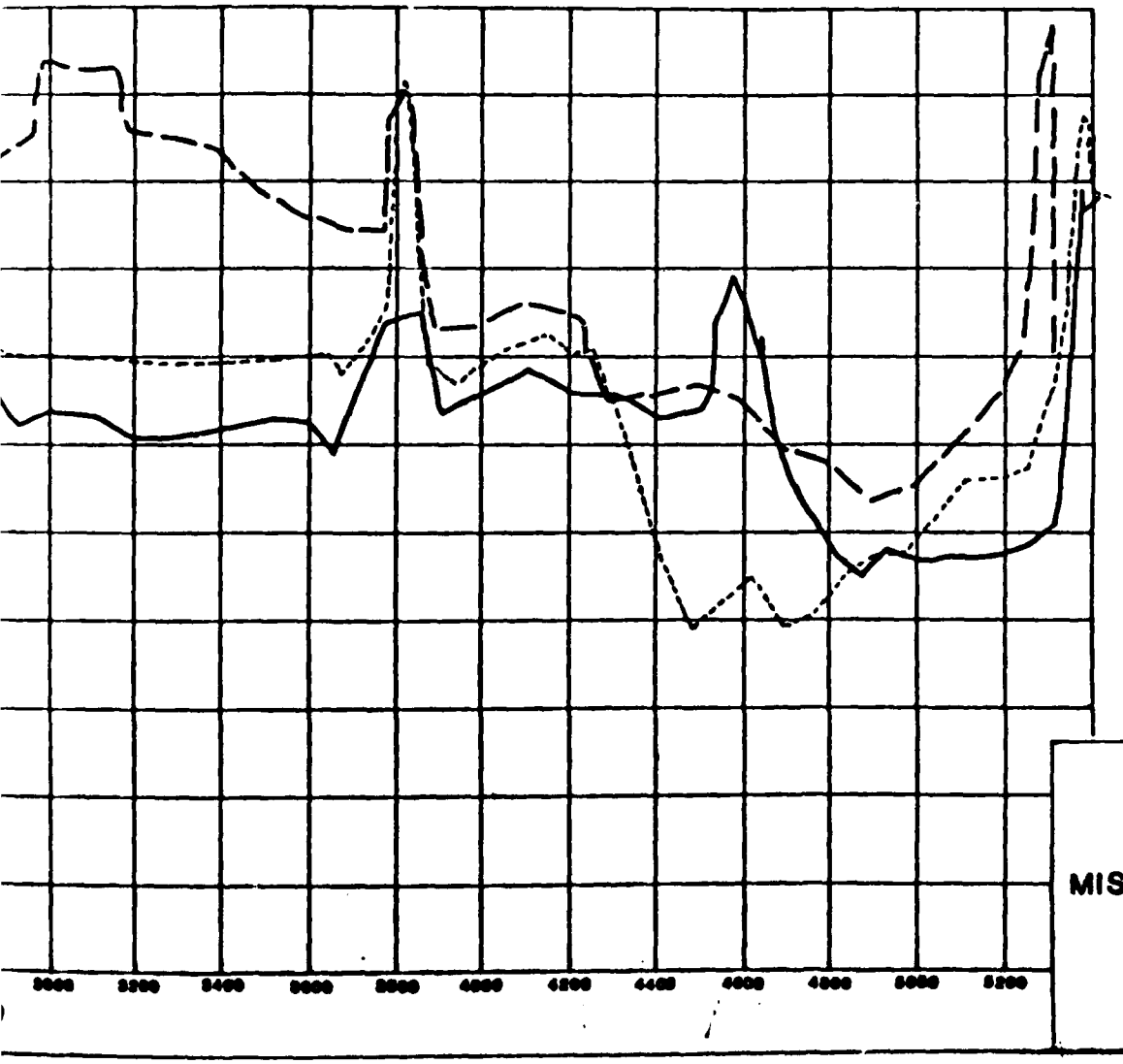
RANGE 327.0

PLATE 7


MISSISSIPPI RIVER
BURLINGTON NORTHERN RR
Range 328


POOL ELEVATION 470.0
ELEVATION
RANGE 328.0





LEGEND:

1938

1953

1978

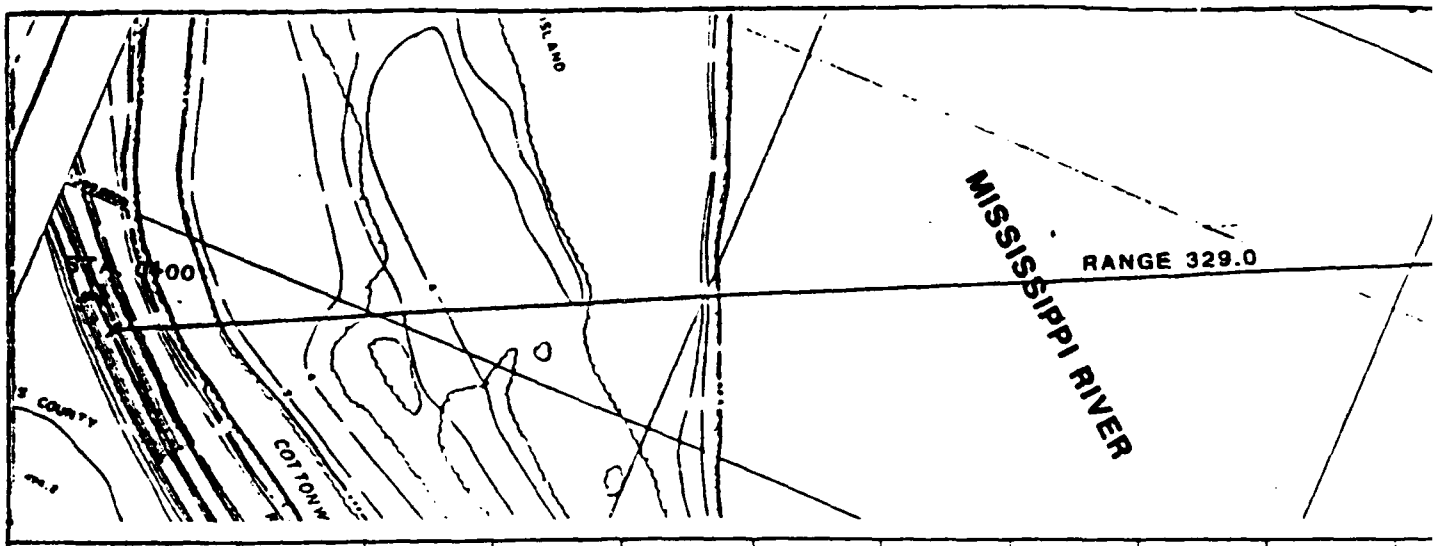
QUINCY, ILLINOIS

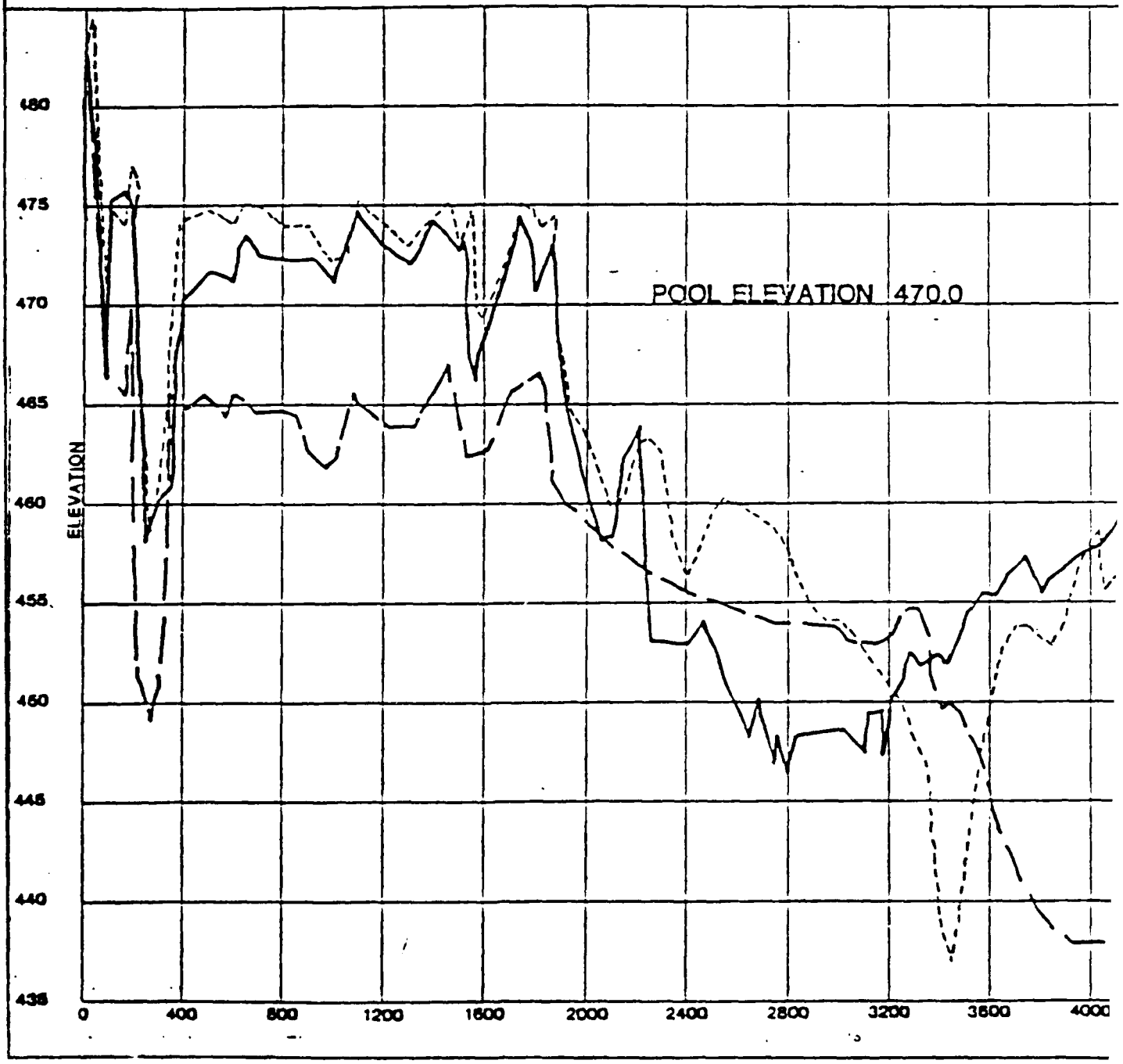
MISSISSIPPI RIVER PROFILE

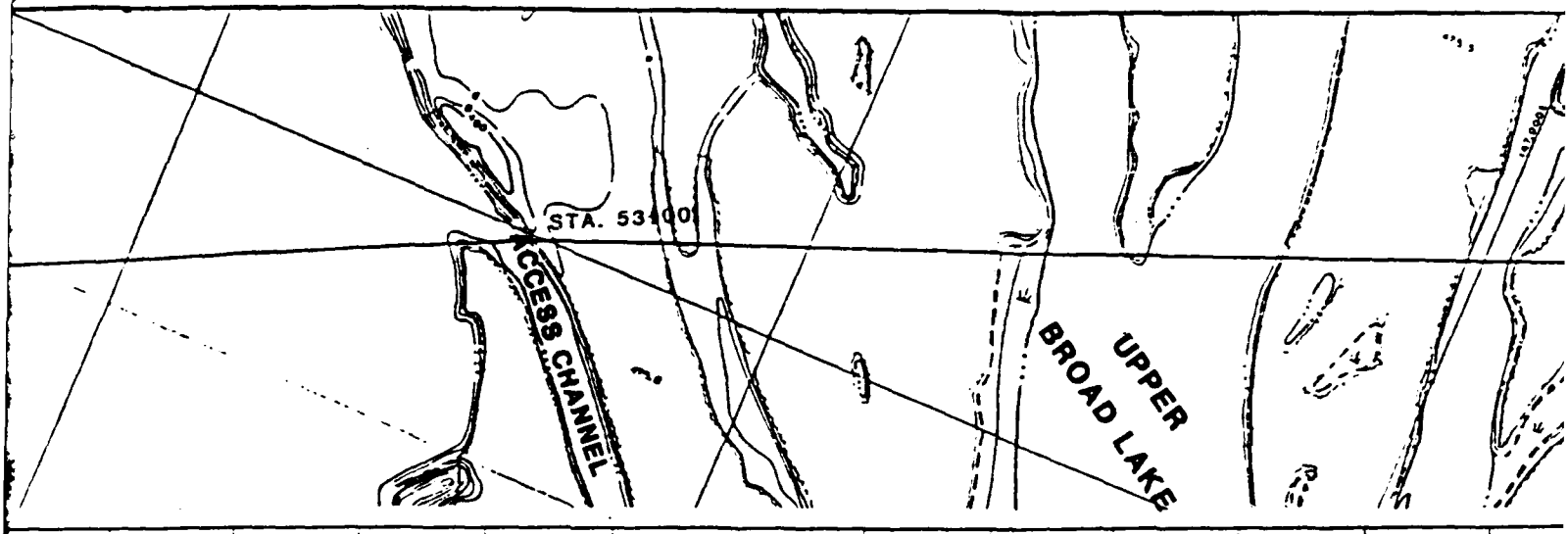
AT

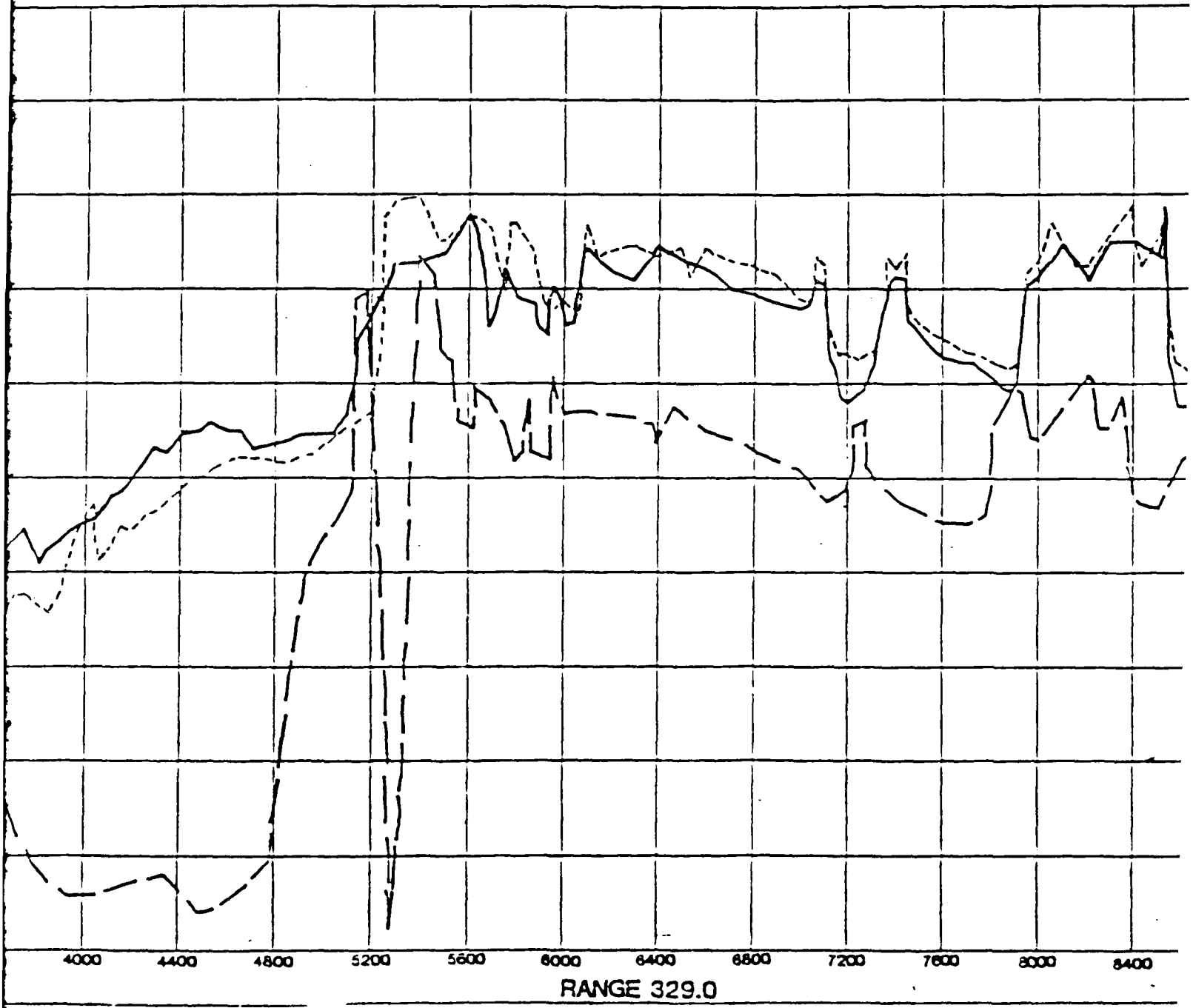
RANGE 328.0

PLATE 8

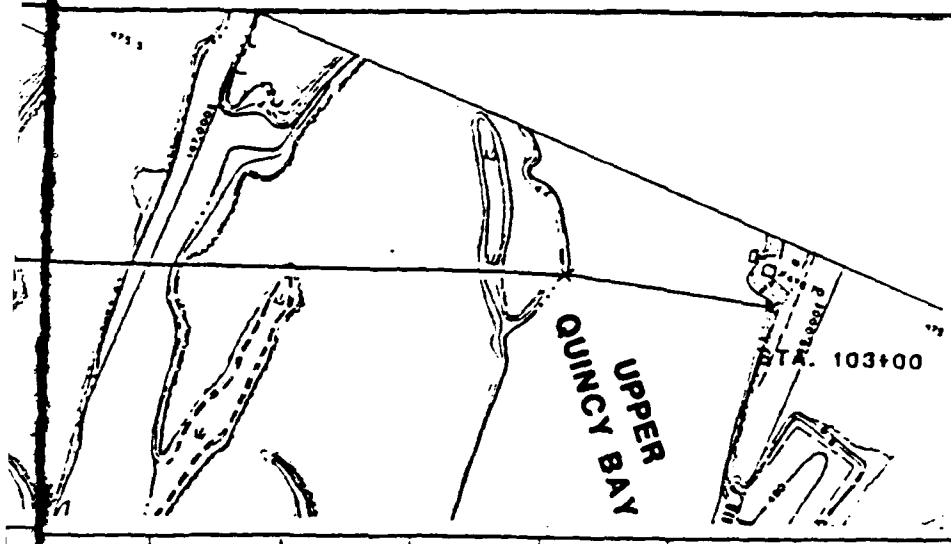

MISSISSIPPI RIVER
RANGE 329.0
COTTONW


POOL ELEVATION 470.0
ELEVATION
480
475
470
465
460
455
450
445
440
435
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000


STA. 53400
ACCESS CHANNEL
UPPER
BROAD LAKE


4000
4400
4800
5200
5600
6000
6400
6800
7200
7600
8000
8400

RANGE 329.0



LEGEND:

1938

1953

1978

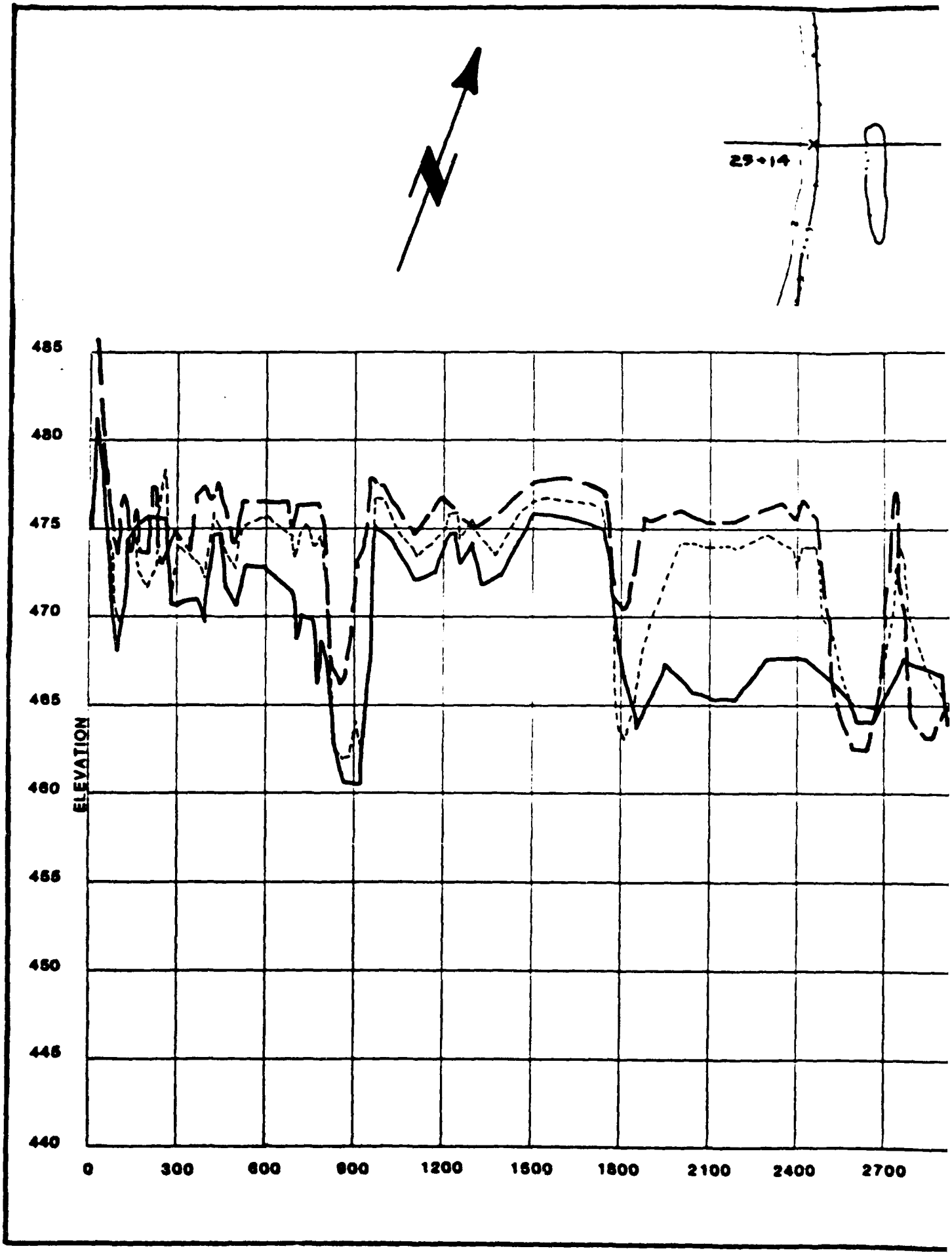
8400 8800 9200 9600 10000 10400 10800

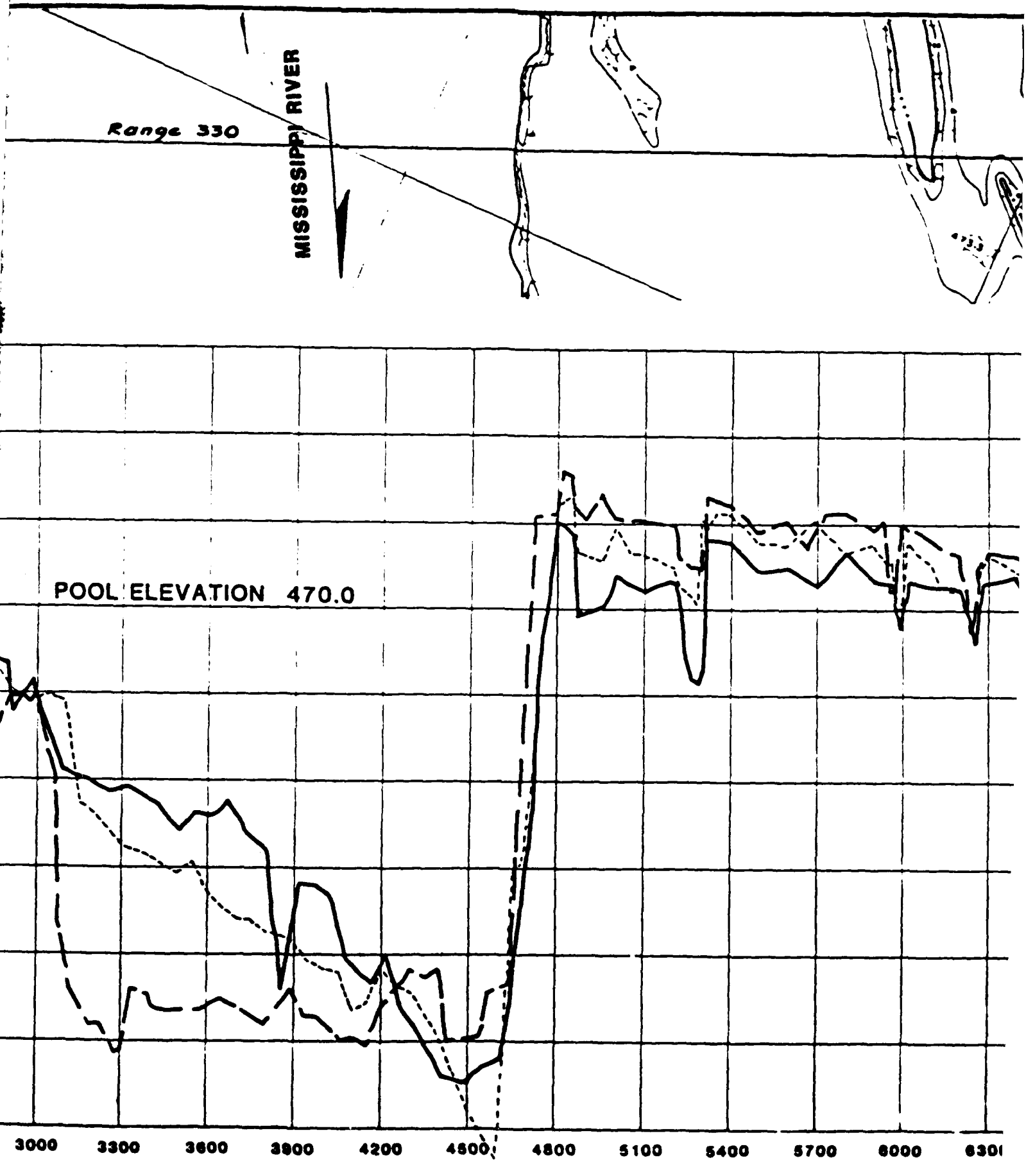
QUINCY, ILLINOIS

MISSISSIPPI RIVER
PROFILE AT

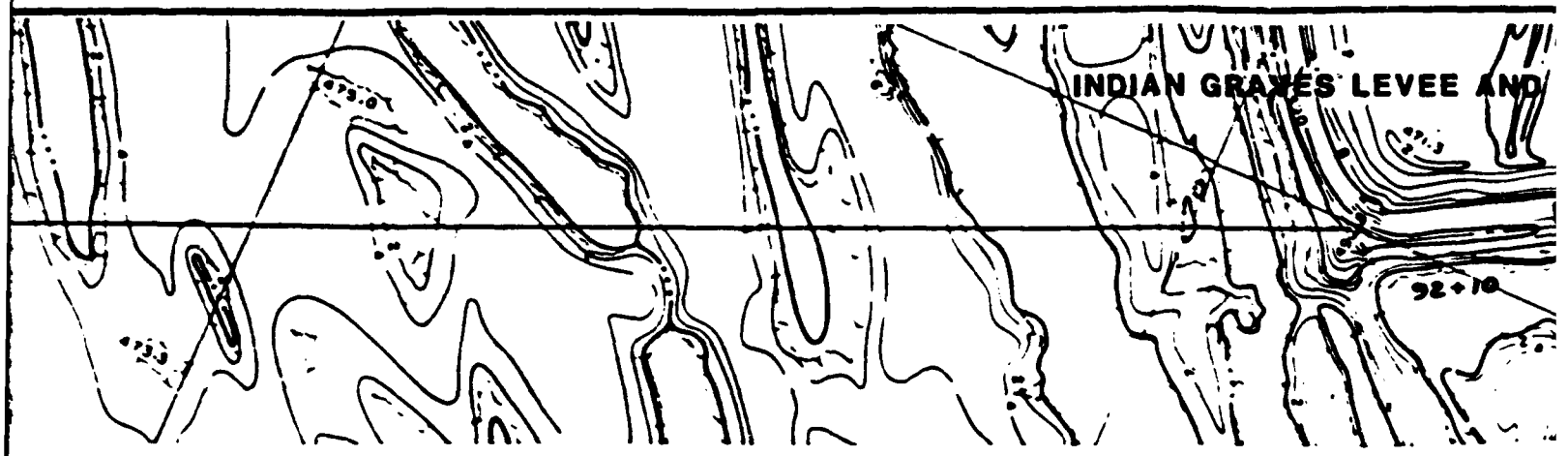
RANGE 329.0

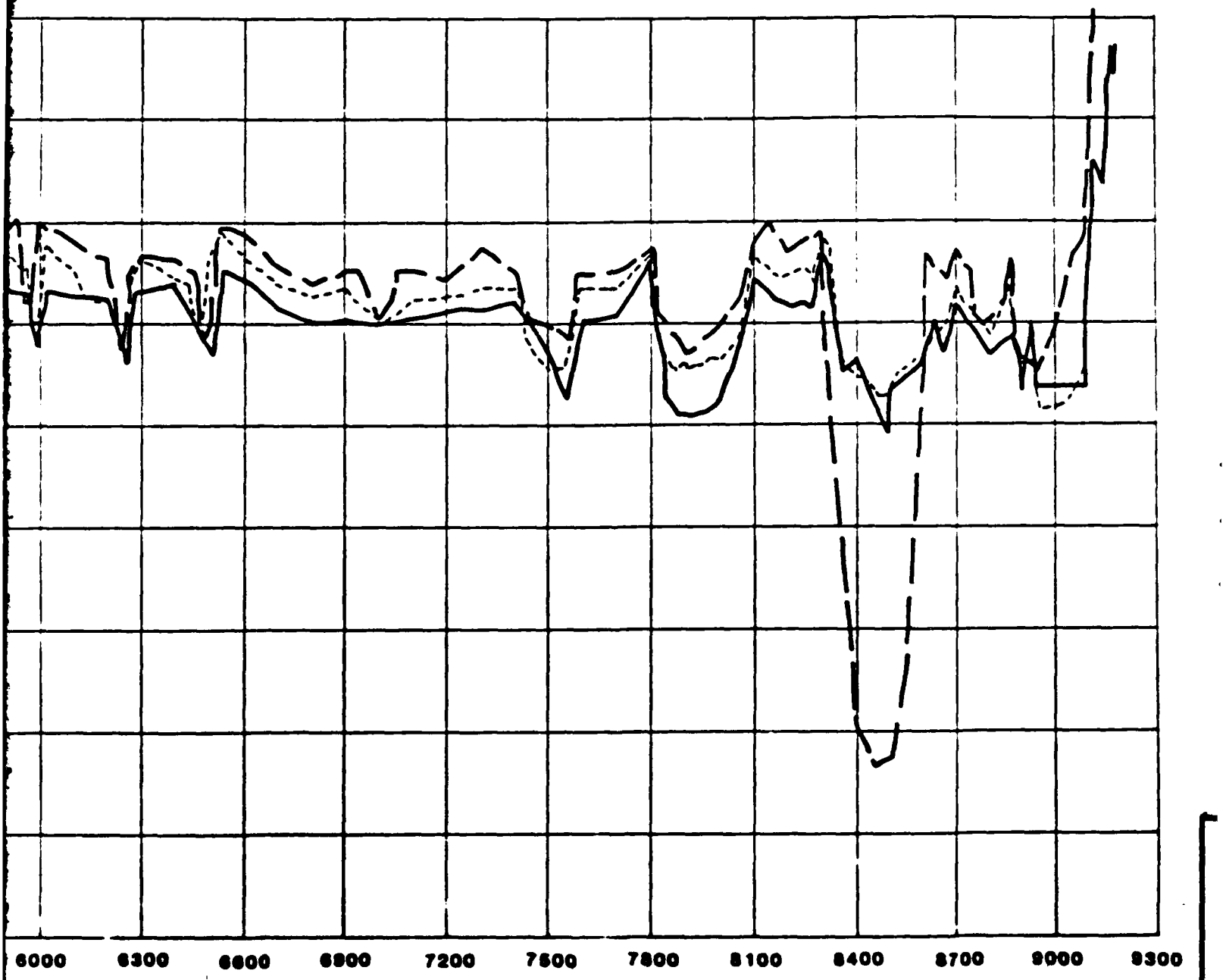
PLATE

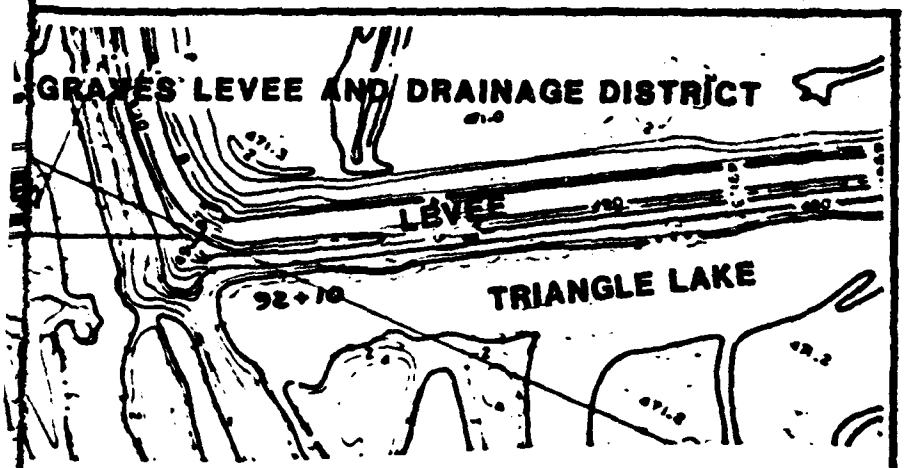

29+14
485
480
475
470
465
460
455
450
445
440
ELEVATION
0
300
600
900
1200
1500
1800
2100
2400
2700

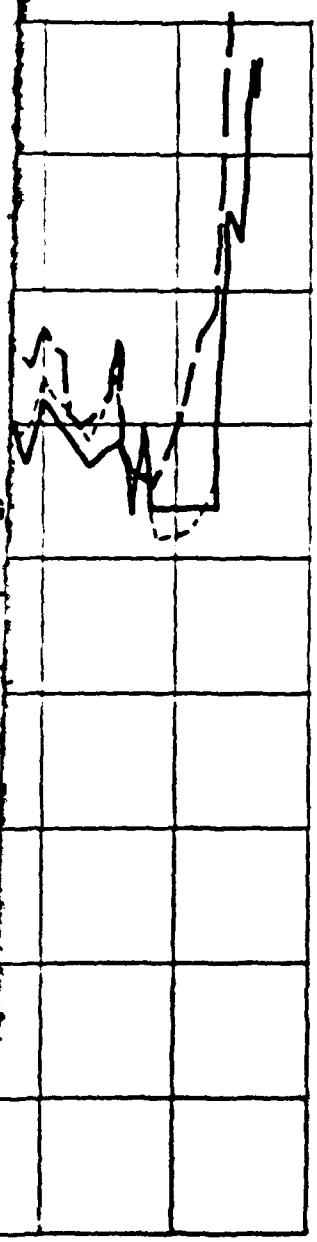

Range 330
MISSISSIPPI RIVER
POOL ELEVATION 470.0
3000
3300
3600
3900
4200
4500
4800
5100
5400
5700
6000

RANGE 330.0


INDIAN GRAVES LEVEE AND
92+10


6000
6300
6600
6900
7200
7500
7800
8100
8400
8700
9000
9300





8700 9000 9300

LEGEND:

1938

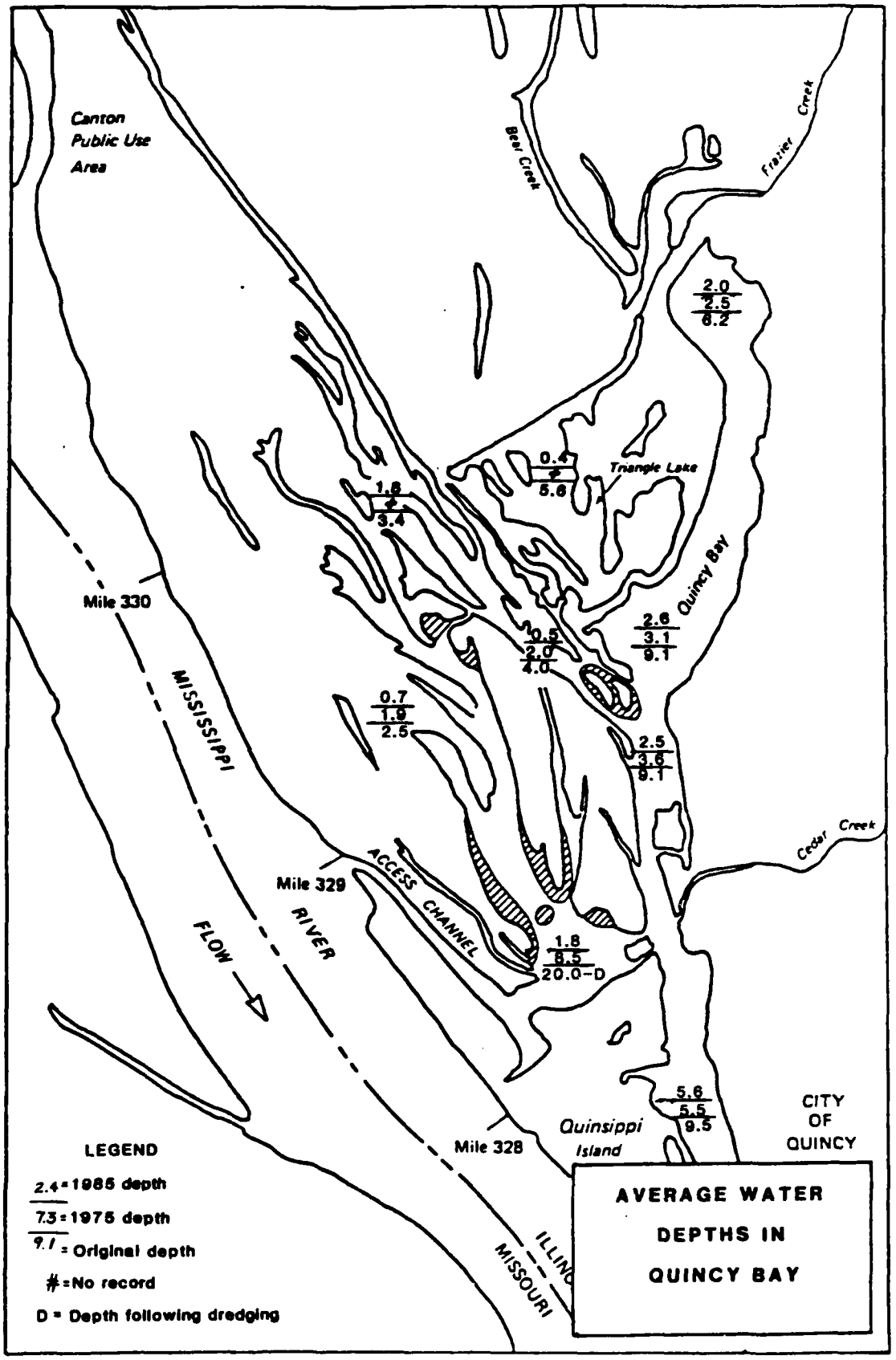
1953

1978

QUINCY, ILLINOIS

MISSISSIPPI RIVER PROFILE
AT
RANGE 330.0

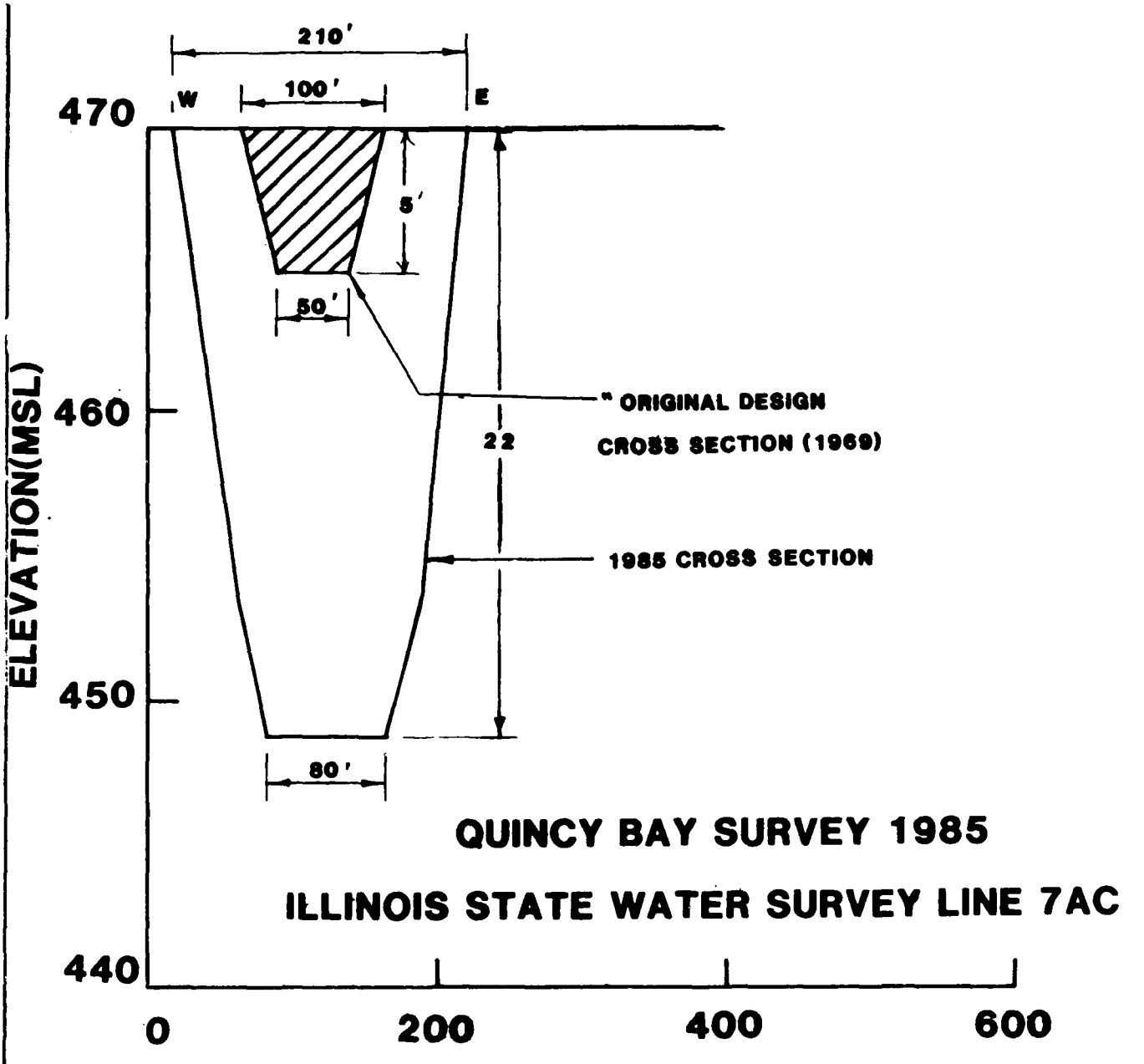
PLATE 10



SCALE OF MILES

0 1 2

PLATE 11

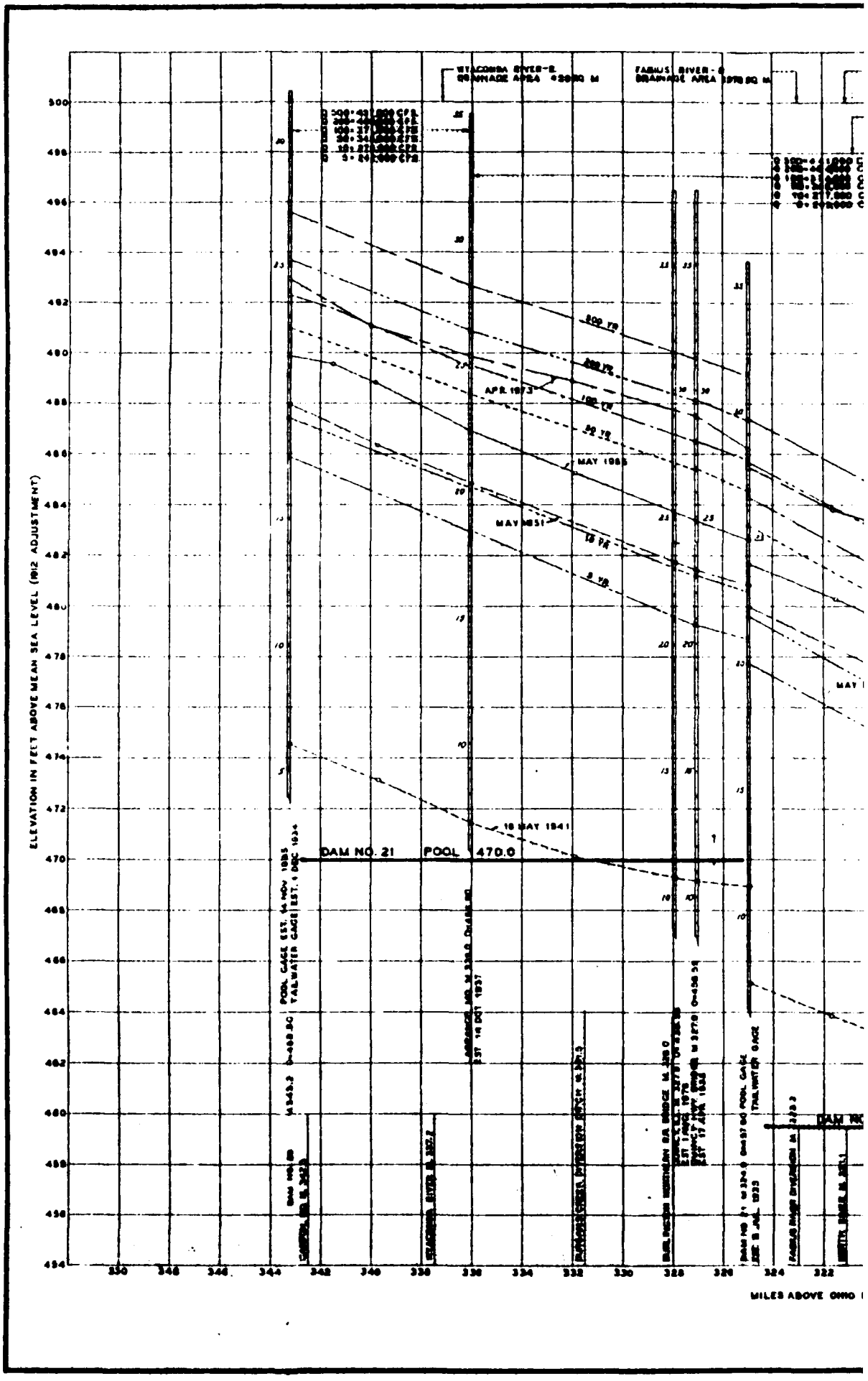


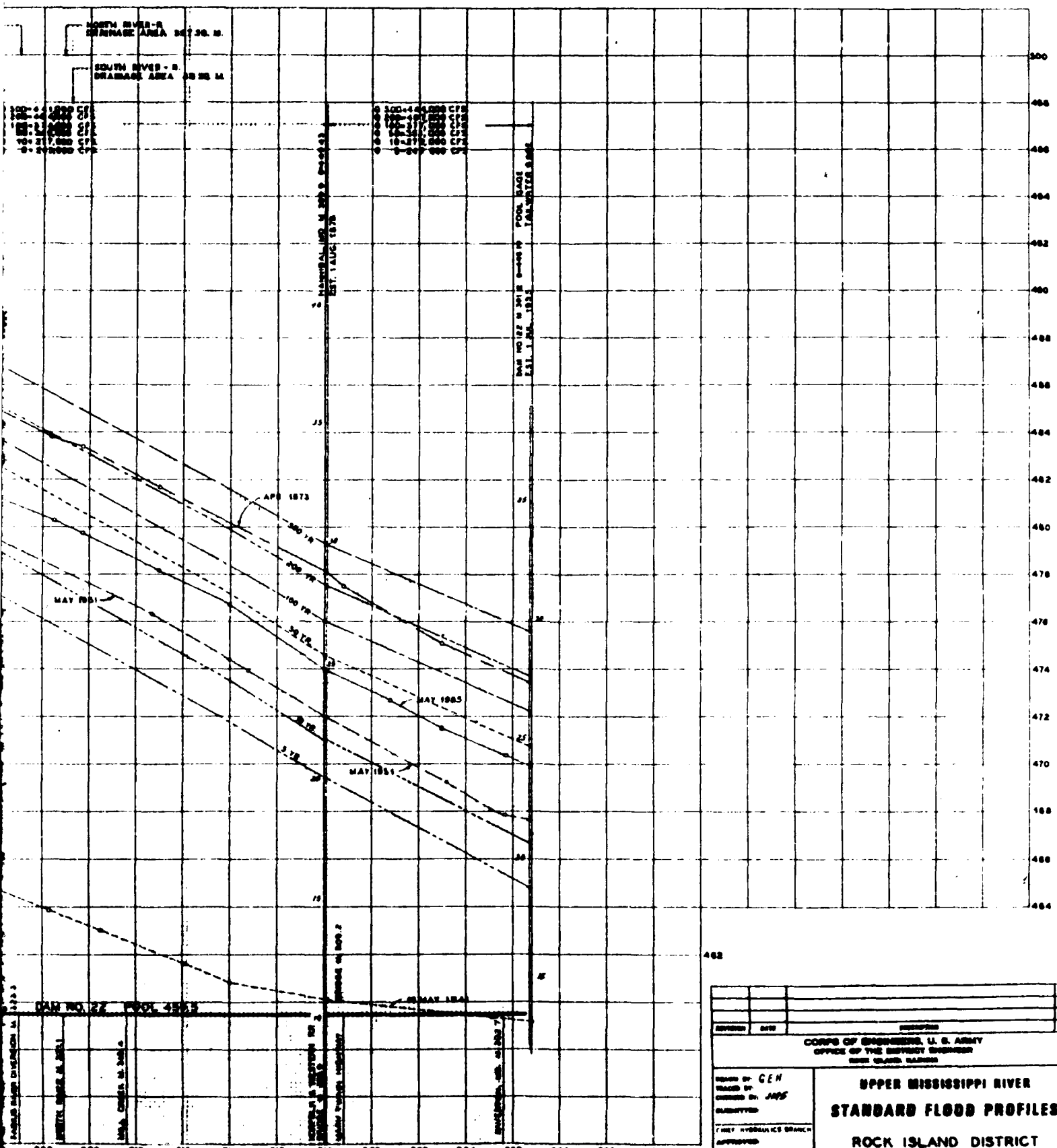
CROSS SECTIONS
NEAR UPPER END
OF ACCESS CHANNEL

QUINCY BAY, ILLINOIS

PLATE 12

CORPS OF ENGINEERS





CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER

DESIGNED BY: GEH
TRACED BY:
CHECKED BY: JAMS
QUANTITIES:
CHIEF HYDRAULICS BRANCH
APPROVED:
CHIEF ENGINEERING DIVISION
DATE:

UPPER MISSISSIPPI RIVER
STANDARD FLOOD PROFILES
ROCK ISLAND DISTRICT

5, 10, 50, 100, 200, & 500 YEAR FLOOD

RIVER MILES 561.2 TO 343.2

DRAWING NO NCR - 5/8

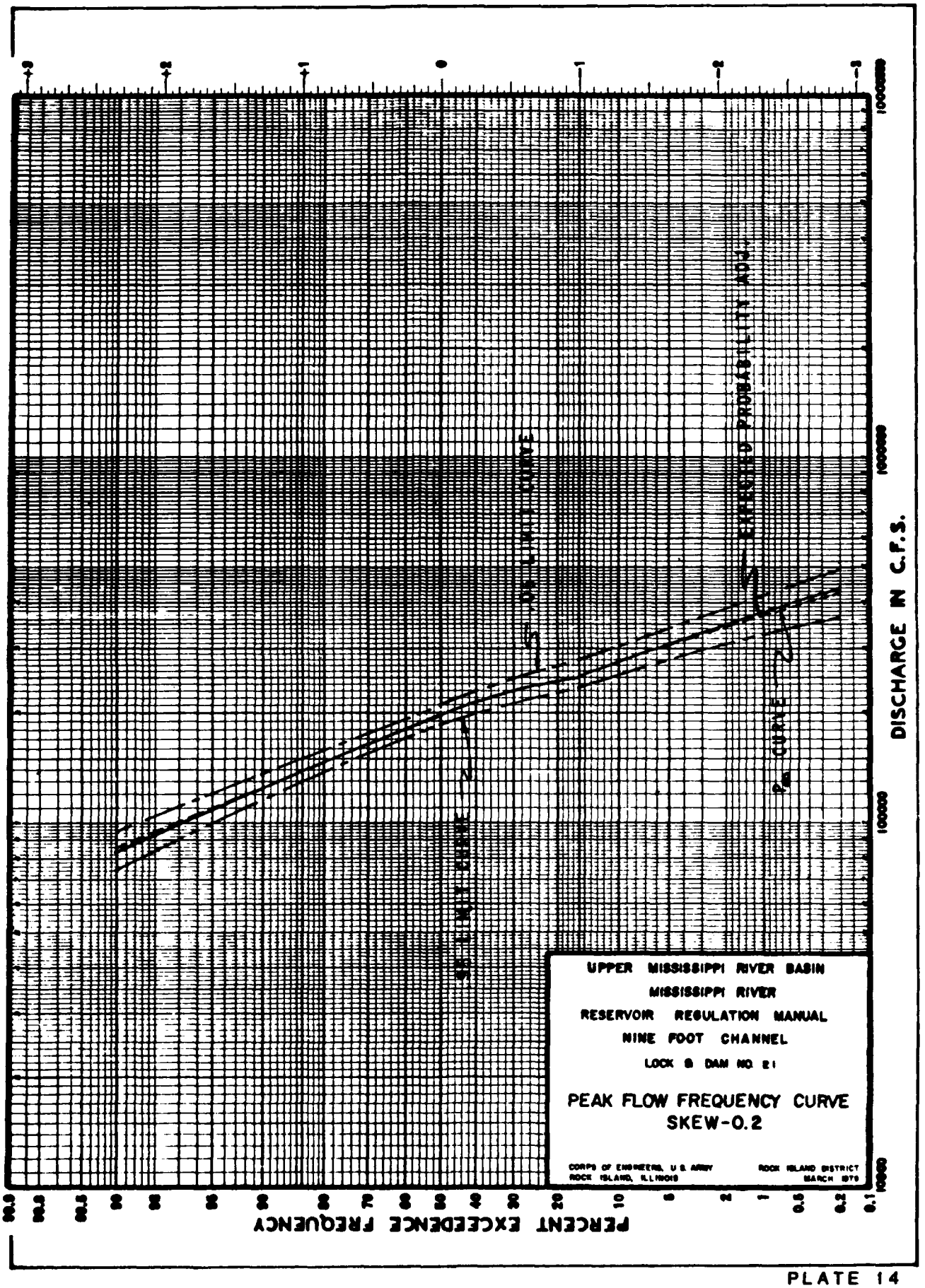
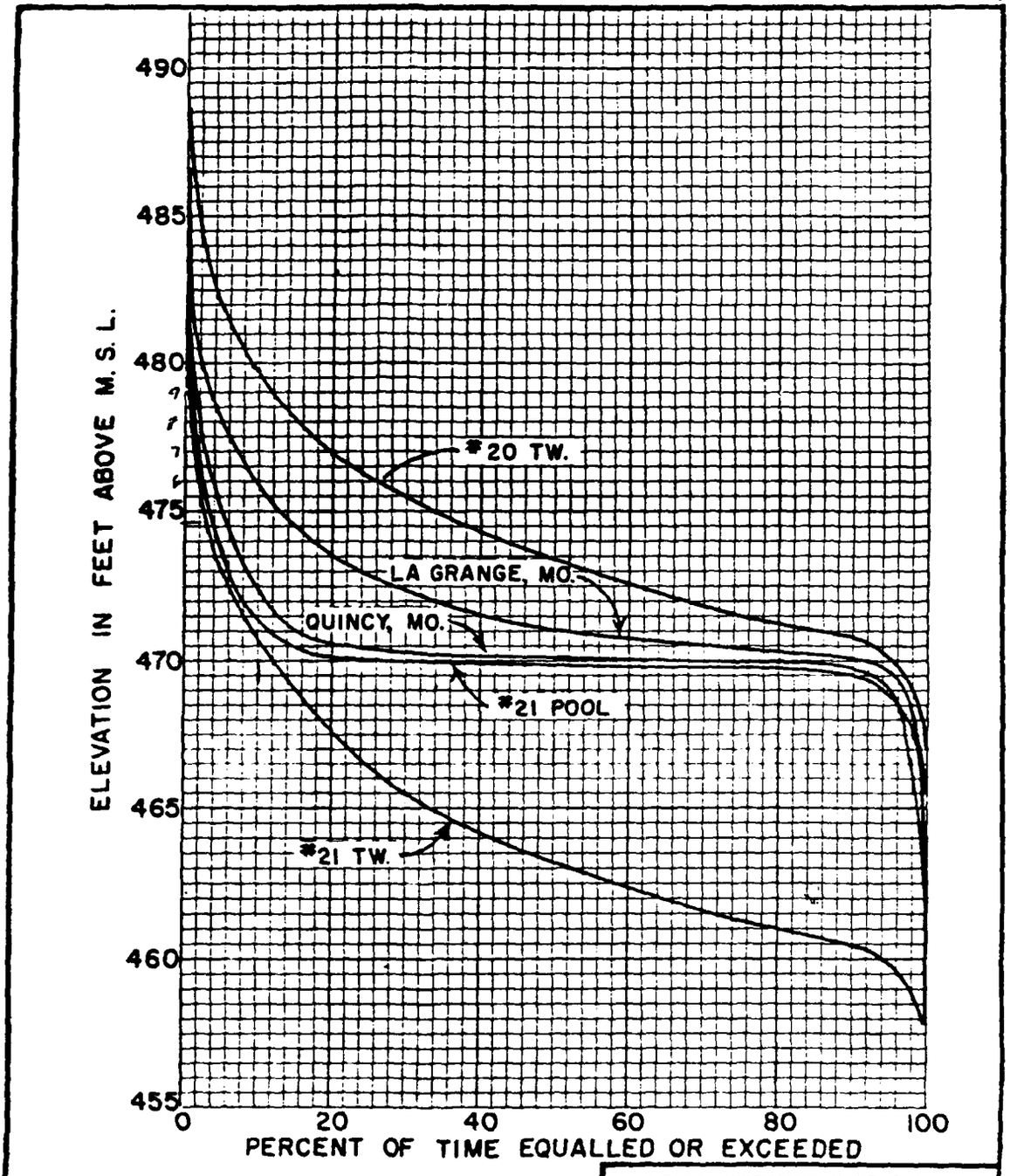

DISCHARGE IN C.F.S.
PERCENT EXCEEDENCE FREQUENCY
EXPECTED PROBABILITY CURVE
95% CONFIDENCE LIMITS
OBSERVED DATA
UPPER MISSISSIPPI RIVER BASIN
MISSISSIPPI RIVER
RESERVOIR REGULATION MANUAL
NINE FOOT CHANNEL
LOCK & DAM NO. 21
PEAK FLOW FREQUENCY CURVE
SKEW-0.2
CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS
ROCK ISLAND DISTRICT
MARCH 1979

PLATE 14

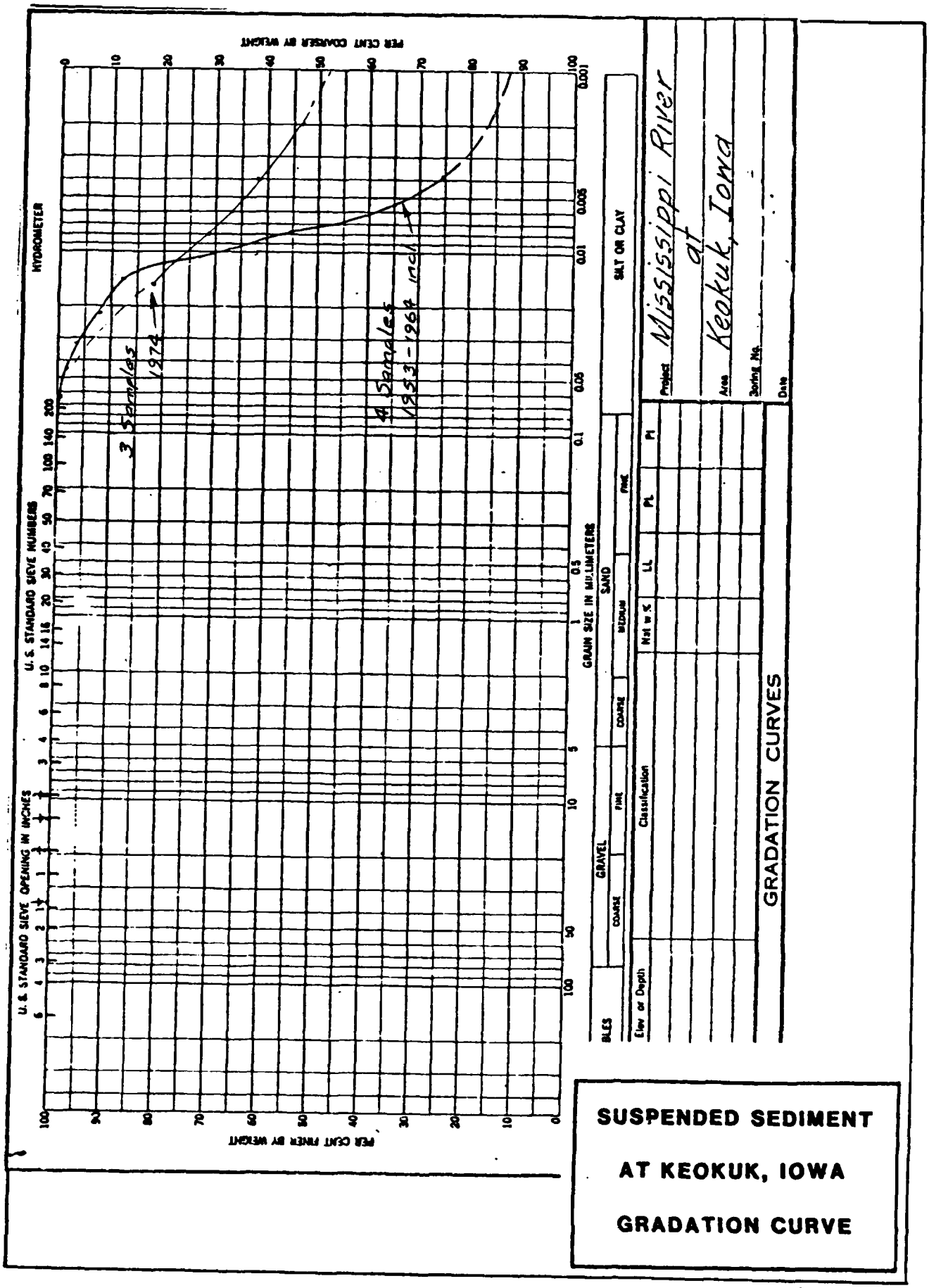


PERIOD OF RECORD
FOR ALL STATIONS
IS
1940 - 1973

UPPER MISSISSIPPI RIVER BASIN
MISSISSIPPI RIVER
RESERVOIR REGULATION MANUAL
NINE FOOT CHANNEL
POOL 21
ELEVATION DURATION
CURVES

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS
ROCK ISLAND DISTRICT
MARCH 1975

PLATE 15

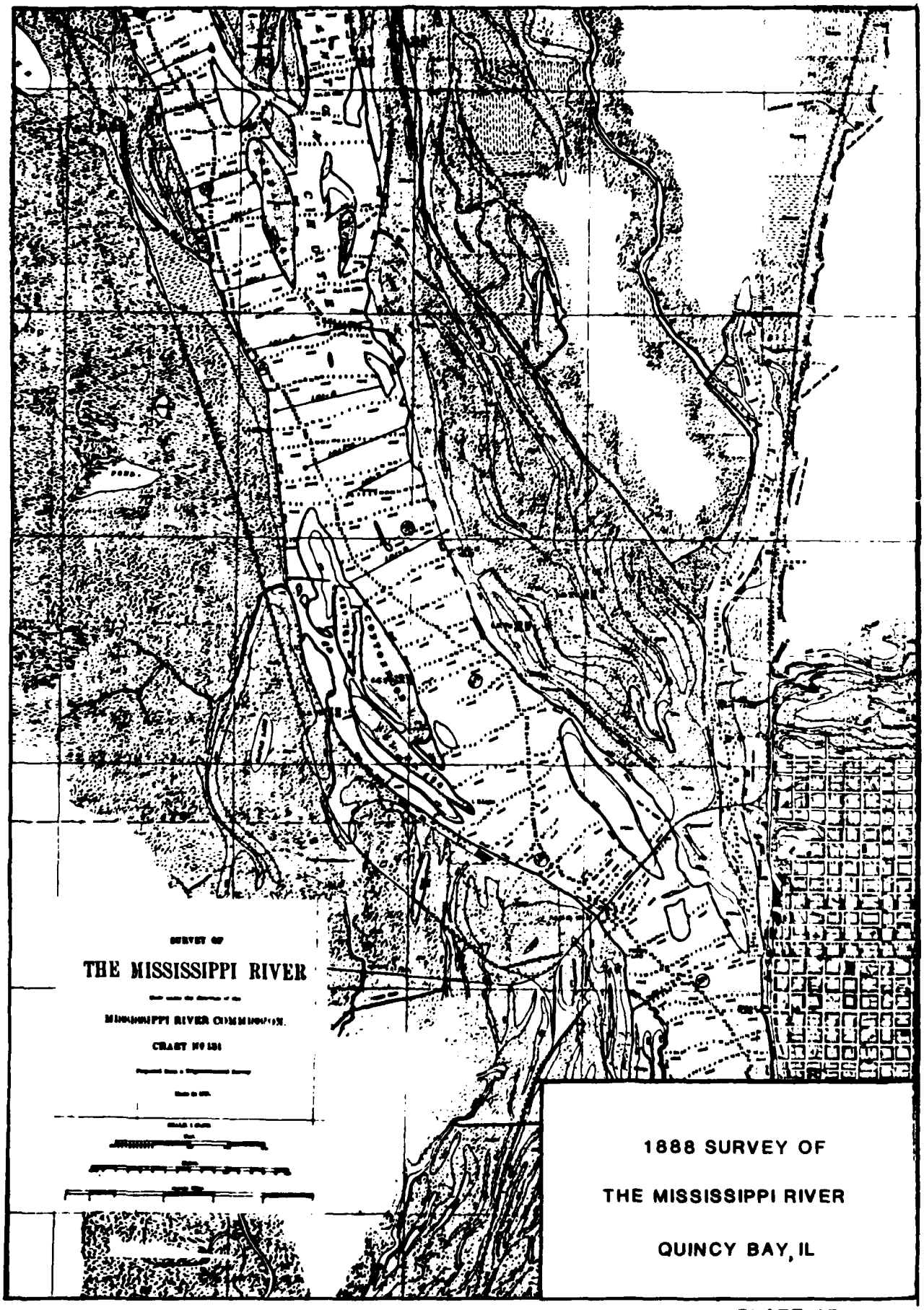


SUSPENDED SEDIMENT

AT KEOKUK, IOWA

GRADATION CURVE

PLATE 16



1888 SURVEY OF

THE MISSISSIPPI RIVER

QUINCY BAY, IL

PLATE 17

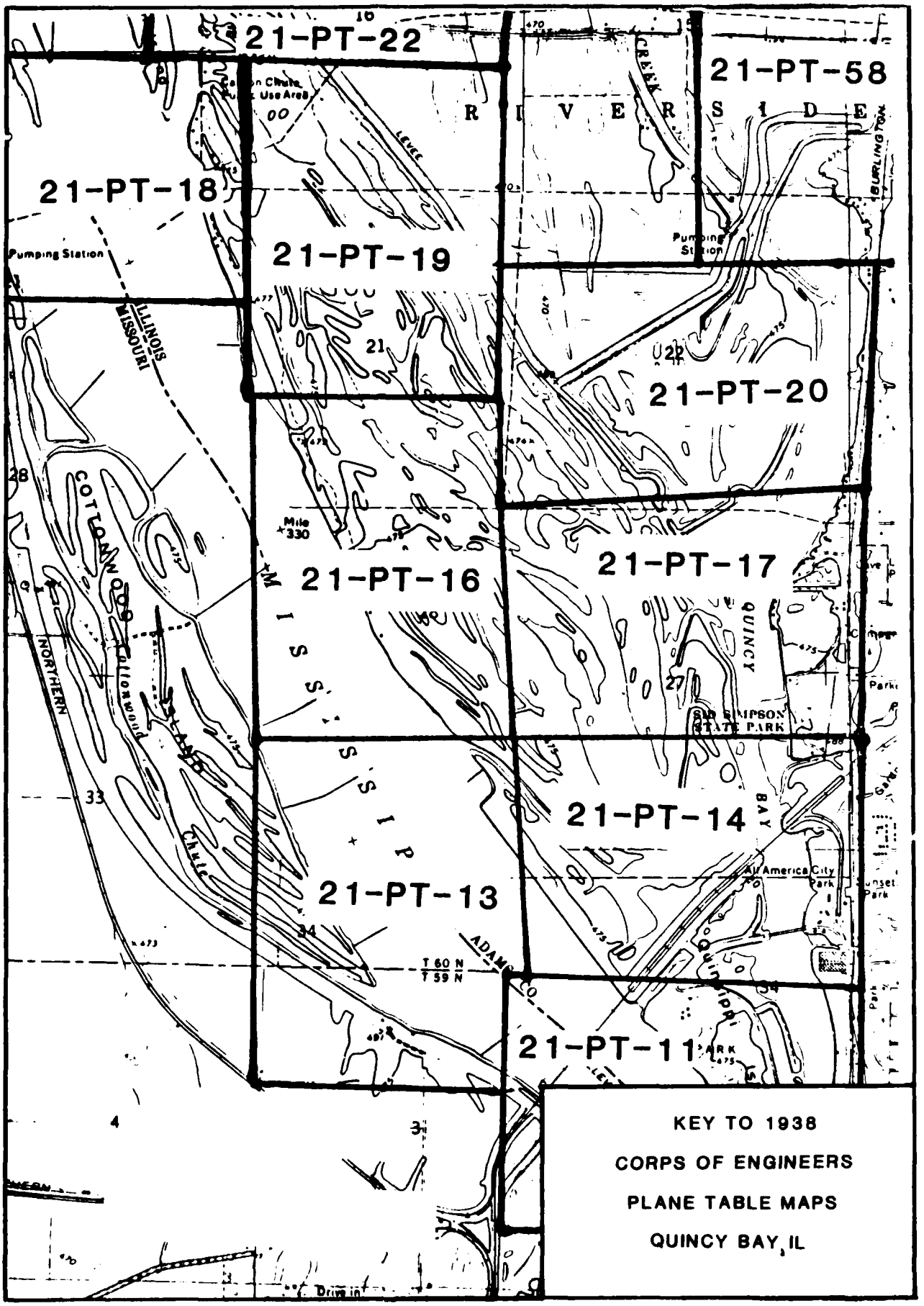
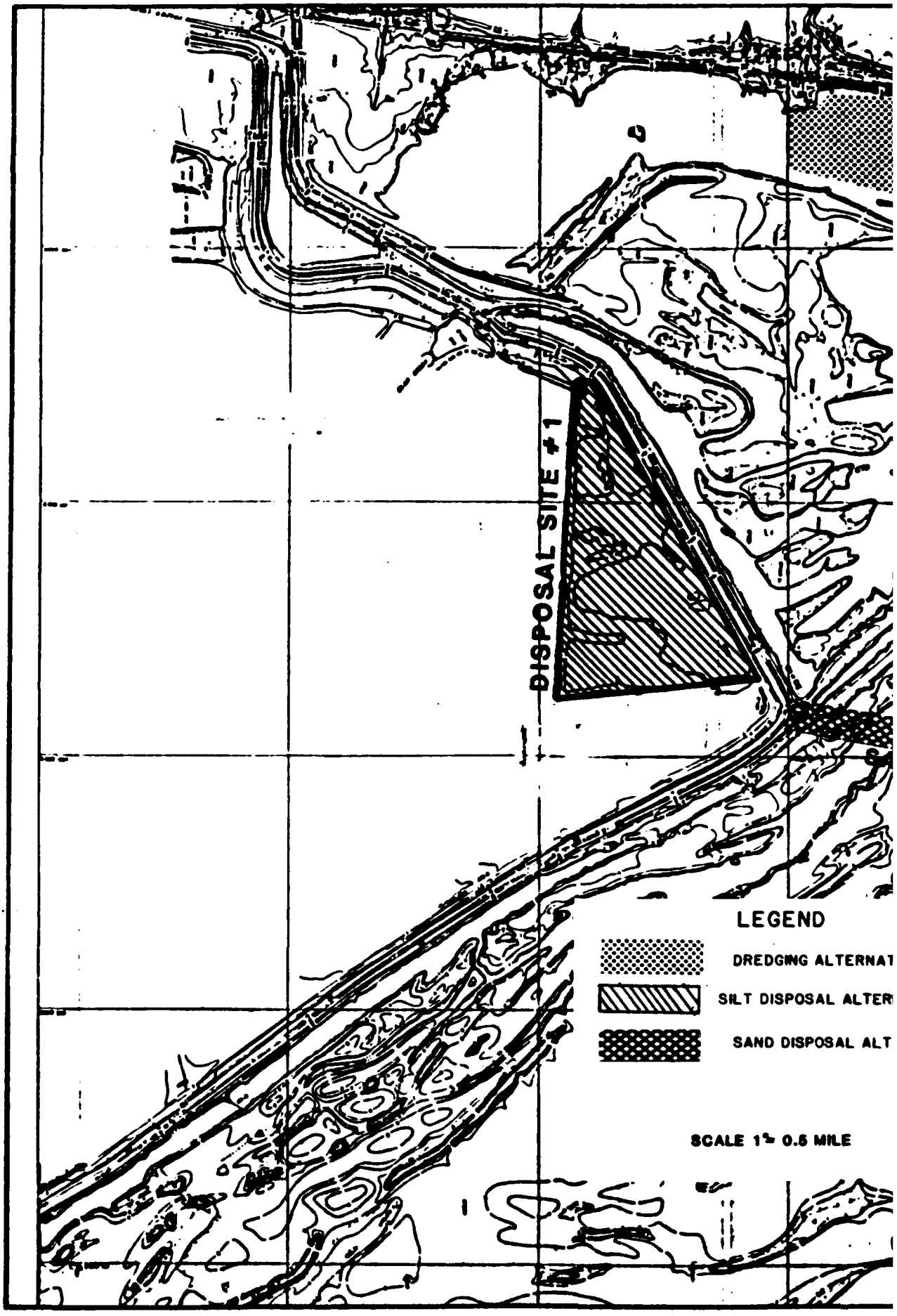

21-PT-22
21-PT-58
21-PT-18
21-PT-19
21-PT-20
21-PT-16
21-PT-17
21-PT-14
21-PT-13
21-PT-11
RIVER SIDE
CREEK
LEVEE
Pumping Station
ILLINOIS
MISSOURI
COTTONWOOD
ISLAND
NORTHERN
MISSISSIPPI
QUINCY
BAY
BURLINGTON
Mile 330
T 60 N
T 59 N
ADAMS CO.
Drift in
KEY TO 1938
CORPS OF ENGINEERS
PLANE TABLE MAPS
QUINCY BAY, IL

PLATE 18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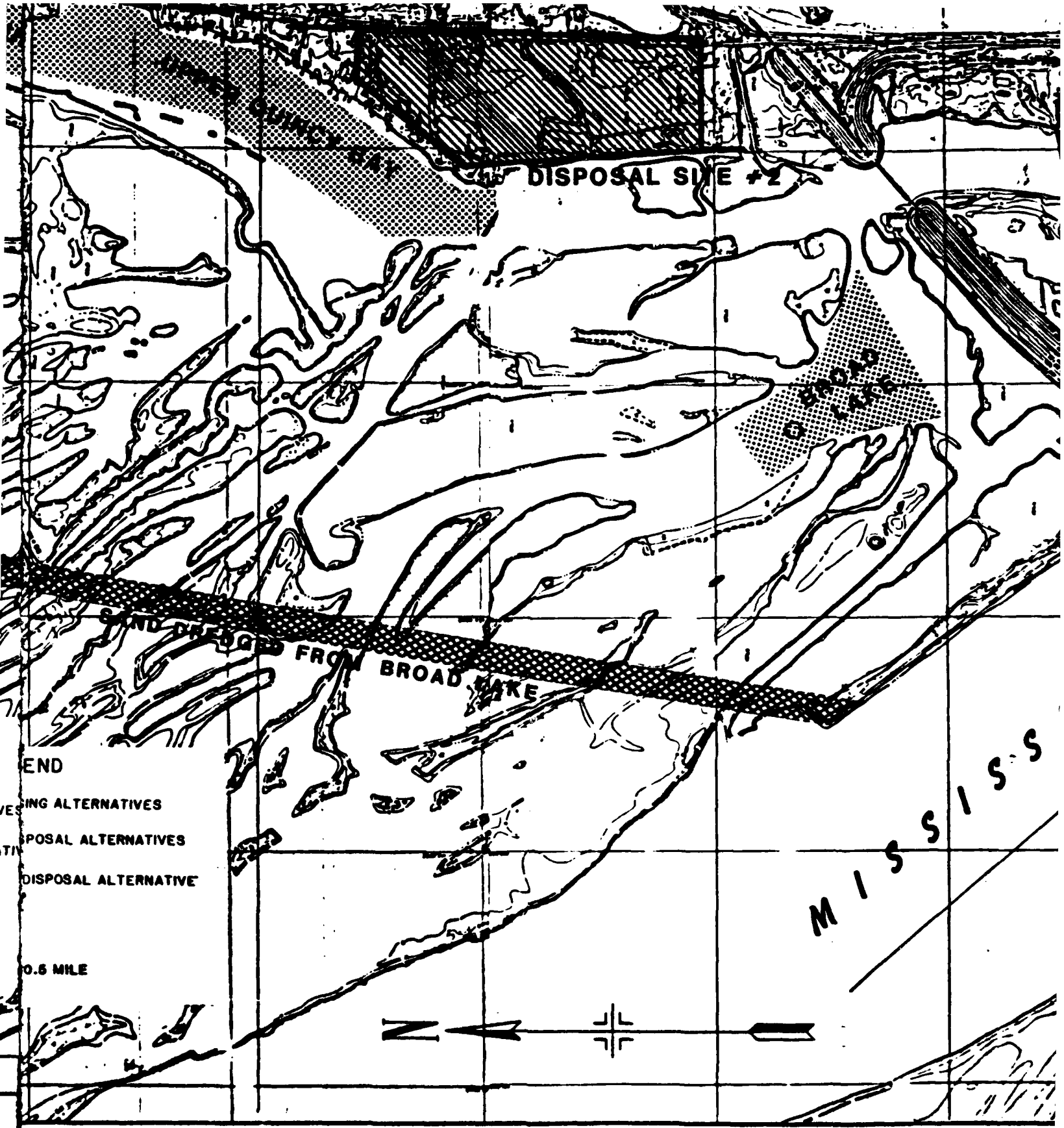
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FROM BROAD LAKE
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DISPOSAL ALTERNATIVE
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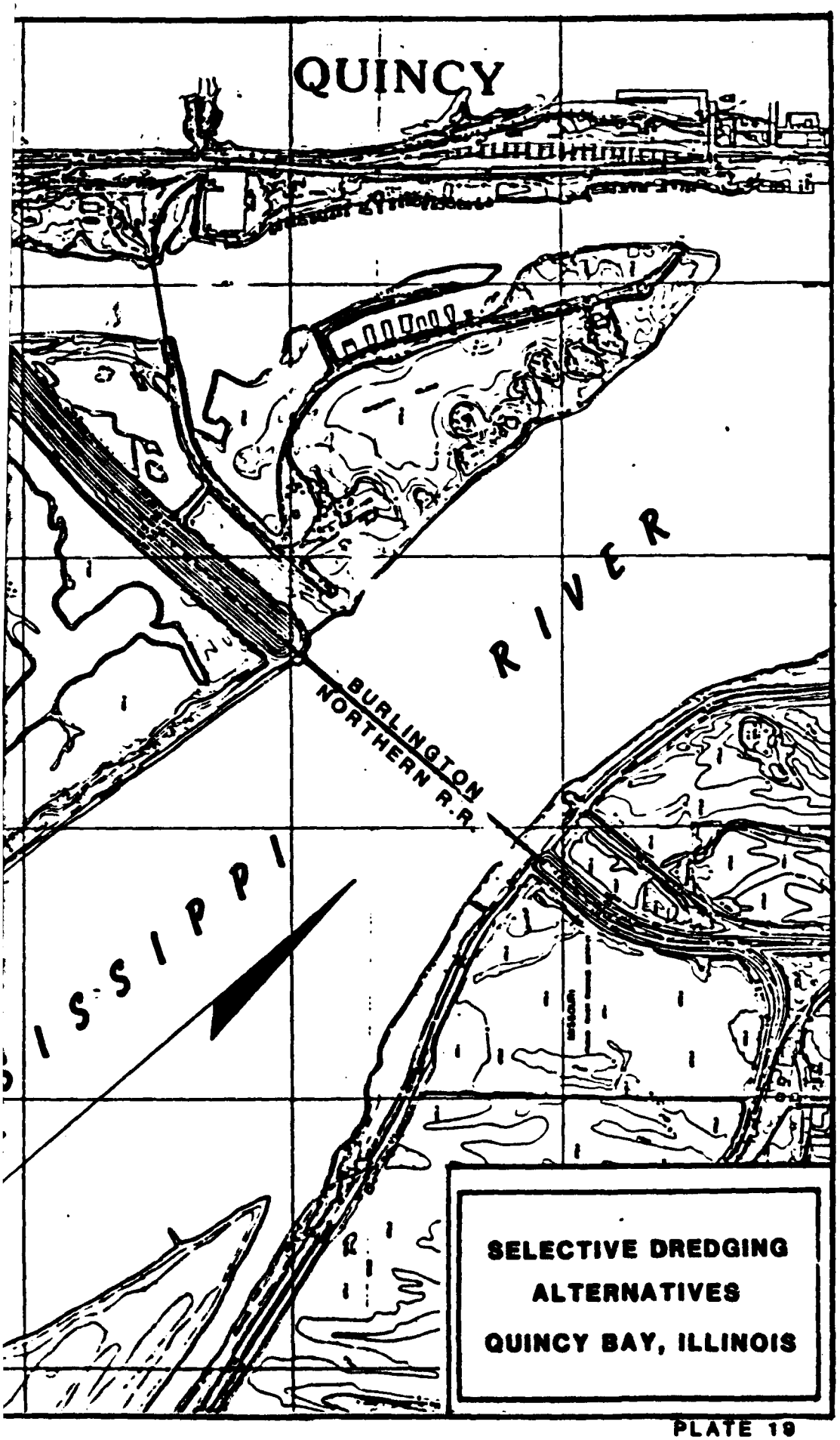
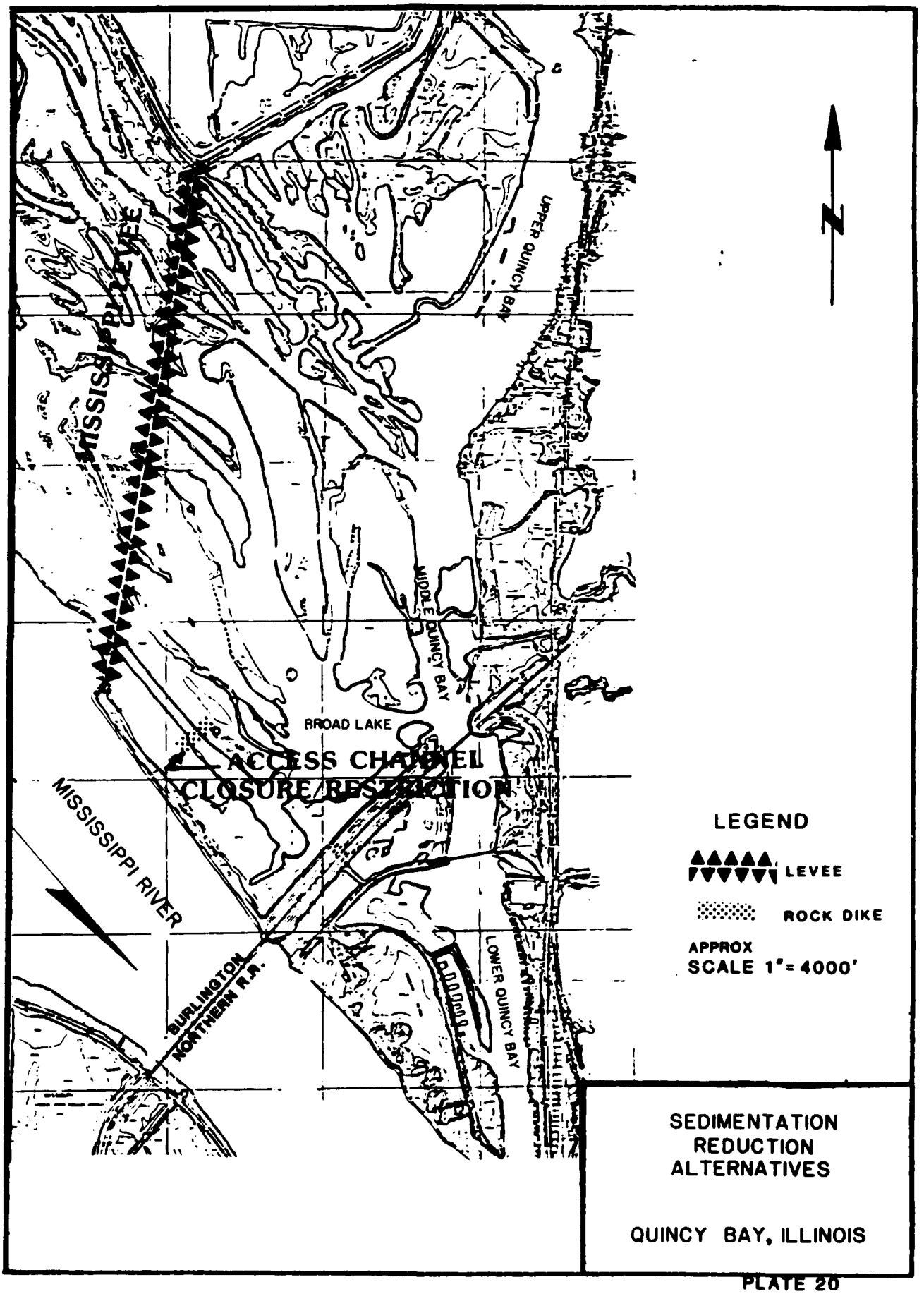

QUINCY
RIVER
BURLINGTON NORTHERN R.R.
SELECTIVE DREDGING
ALTERNATIVES
QUINCY BAY, ILLINOIS

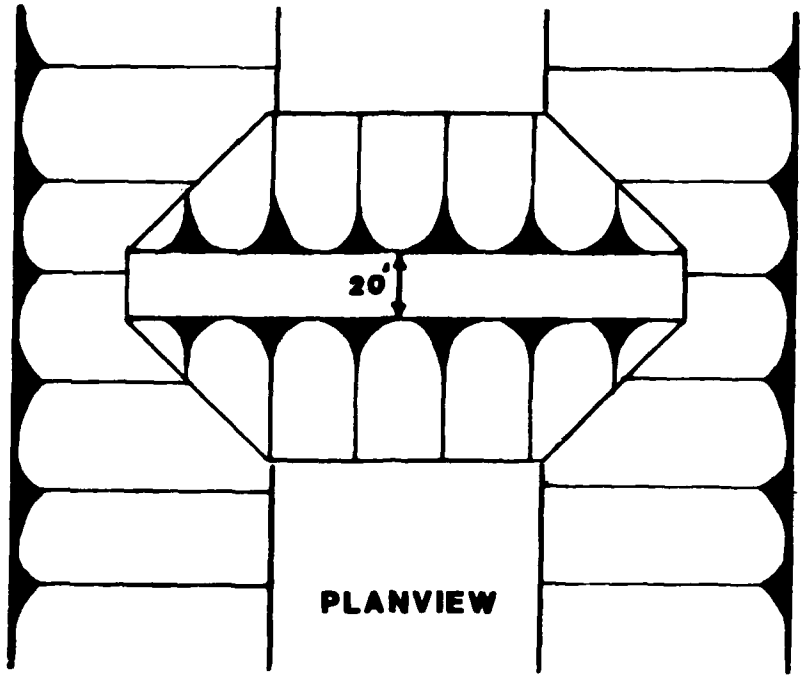
PLATE 19



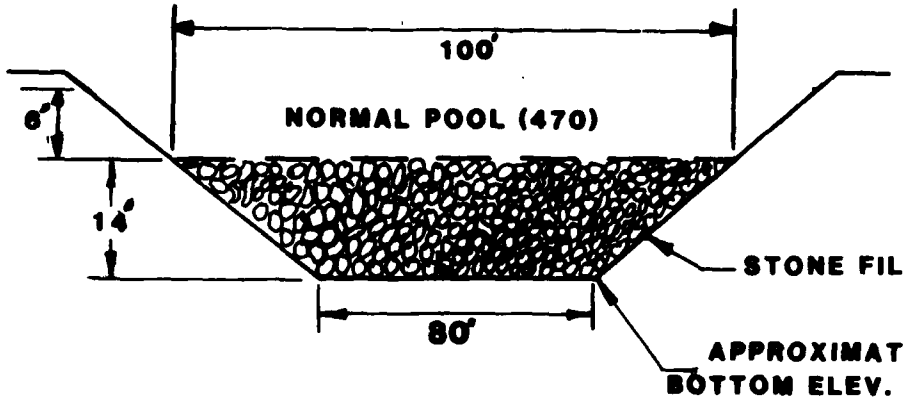
SEDIMENTATION
REDUCTION
ALTERNATIVES

QUINCY BAY, ILLINOIS

PLATE 20



PLANVIEW



PROFILE

PRELIMINARY DESIGN
ACCESS CHANNEL
RESTRICTION
QUINCY BAY, IL

PLATE 21

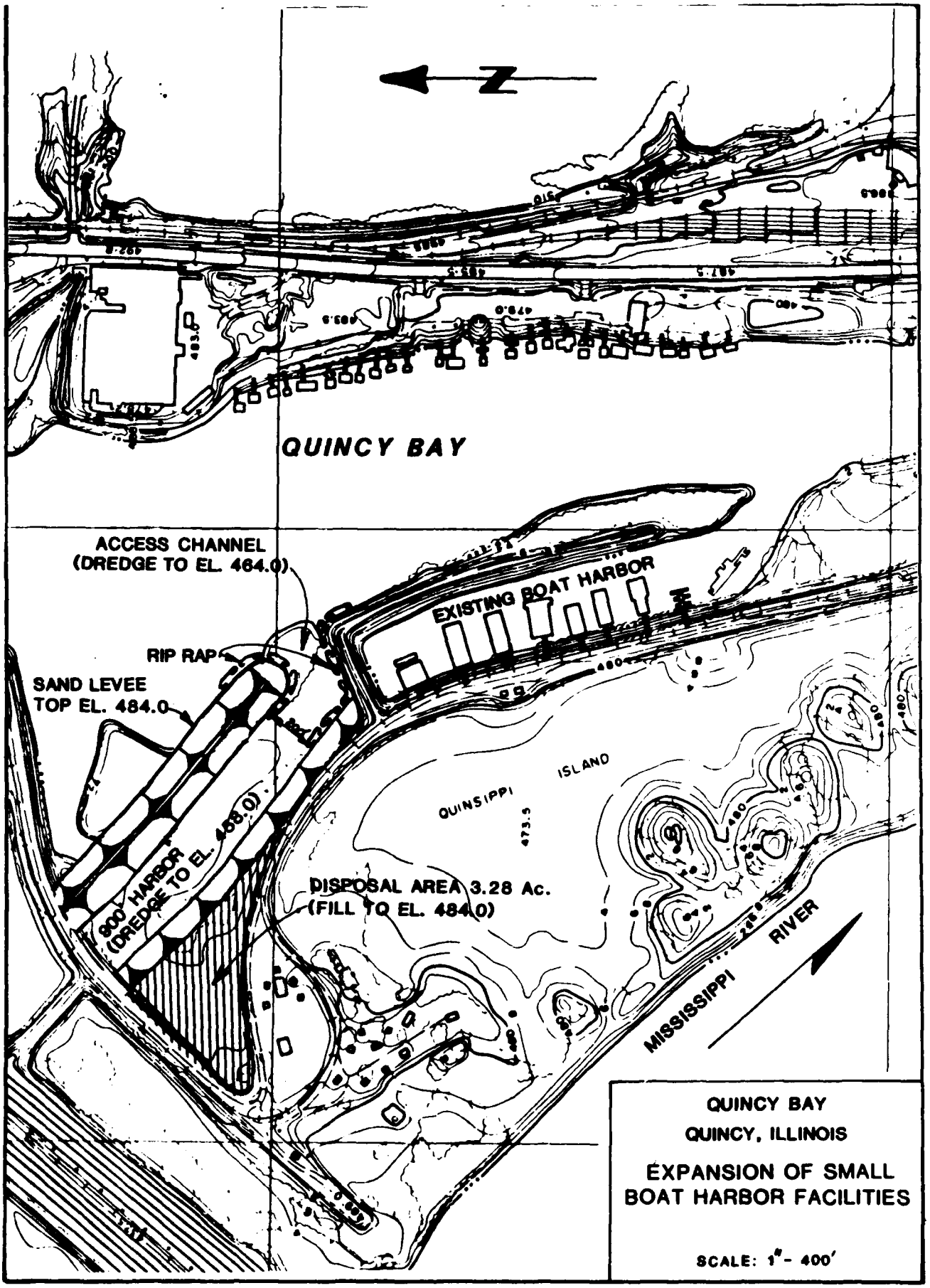
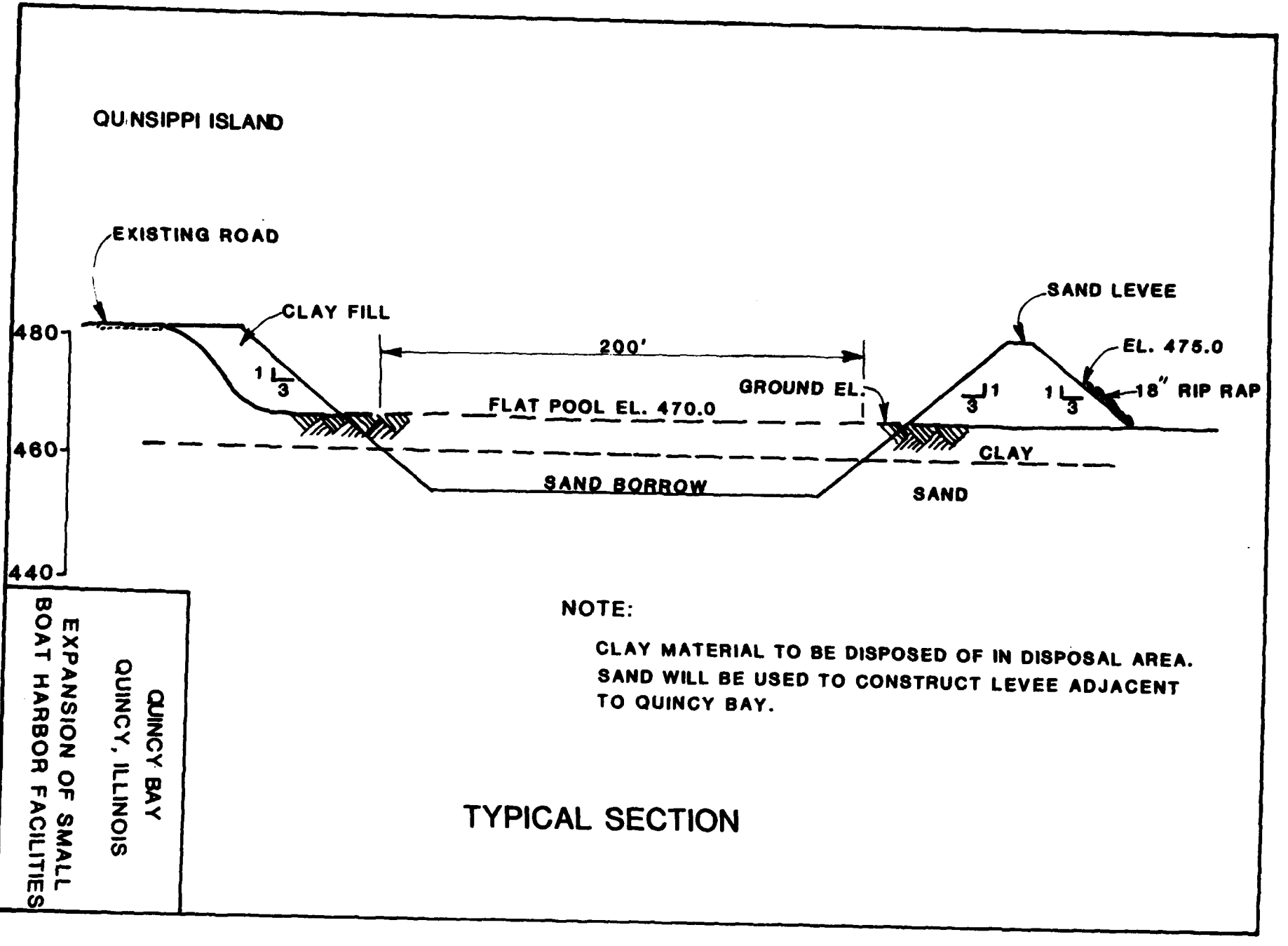

QUINCY BAY
ACCESS CHANNEL
(DREDGE TO EL. 464.0)
EXISTING BOAT HARBOR
RIP RAP
SAND LEVEE
TOP EL. 484.0
ISLAND
QUINSIPPI
473.5
900' HARBOR
(DREDGE TO EL. 468.0)
DISPOSAL AREA 3.28 Ac.
(FILL TO EL. 484.0)
MISSISSIPPI
RIVER
QUINCY BAY
QUINCY, ILLINOIS
EXPANSION OF SMALL
BOAT HARBOR FACILITIES
SCALE: 1" - 400'

PLATE 22



NOTE:

CLAY MATERIAL TO BE DISPOSED OF IN DISPOSAL AREA. SAND WILL BE USED TO CONSTRUCT LEVEE ADJACENT TO QUINCY BAY.

TYPICAL SECTION

EXPANSION OF SMALL BOAT HARBOR FACILITIES
QUINCY BAY
QUINCY, ILLINOIS
PLATE 23

APPENDIX A

ECONOMIC ANALYSIS

RECONNAISSANCE REPORT
SEDIMENTATION PROBLEM

QUINCY BAY, ILLINOIS

APPENDIX A
ECONOMIC ANALYSIS

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RECONNAISSANCE REPORT
SEDIMENTATION PROBLEM

QUINCY BAY, ILLINOIS

APPENDIX A
ECONOMIC ANALYSIS

SECTION 1 - INTRODUCTION

GENERAL ECONOMIC CONDITIONS

Quincy Bay is a complex backwater area lying at the southern end of Pool 21 of the Upper Mississippi River adjacent to the city of Quincy, Illinois. The city of Quincy is the largest city and focal point of Adams County, which is located in the western portion of the state. The 1980 population estimate of 42,554 persons for the city of Quincy represented a 6.0 percent decrease from the previous census. Population projections, however, forecast a moderate increase for the decade of the 1990's. Recent population trends for the city of Quincy and surrounding areas are presented in table A-1. Projected population data for Adams County and the State of Illinois are presented in table A-2.

TABLE A-1

Recent Population Trends for Quincy, Illinois and Surrounding Area

Area	1960	1970	Percent Change	1980	Percent Change
Quincy, IL	43,793	45,288	3.4	42,554	(6.0)
Adams County	68,467	70,893	3.5	71,652	1.1
State of Illinois	10,081,158	11,134,893	10.4	11,197,014	0.6

TABLE A-2

Projected Population for Adams County and State of Illinois [1/]

Area	1985	1990	Percent Change	1995	Percent Change
Adams County	71,707	74,498	3.9	76,228	2.3
State of Illinois	11,584,906	11,687,749	0.9	11,808,364	1.0

1/ Source: Illinois Population Trends from 1970-2025; State of Illinois, Bureau of the Budget, 1984 edition.

Per capita income for Adams County in 1980 was $10,195. This value was nearly 12.0 percent less than the State per capita income of $11,572. Recent employment data indicate that approximately 21,500 persons are employed in Adams County. Primary employment opportunities are in manufacturing, retail trade, and various service industries. A listing of employment by industry for Adams County is provided in table A-3.

TABLE A-3

Employment by Industry for Adams County, Illinois
(March 1985)

Industry	Employment
Agriculture, Forestry, and Fishing	78
Mining and Quarrying	15
Construction	644
Manufacturing	6,271
Transportation, Communication, and Utilities	1,282
Wholesale Trade	1,393
Retail Trade	5,309
Finance, Insurance, and Real Estate	871
Service Industries	5,602
TOTAL	21,465

SECTION 2 - RECREATIONAL USAGE OF QUINCY BAY

GENERAL

Boating is the primary recreational activity in the Quincy Bay area, accounting for greater than 40 percent of total recreation activity days. Boating and other recreational activities have been fostered by public and private development and maintenance of facilities on the bay. The Quincy Park District maintains six recreation sites in the bay area which account for the majority of usage of bay facilities. In addition, there are four private boat clubs and one ramp area maintained by the U.S. Army Corps of Engineers. These sites, as well as ownership, are identified in table A-4 and also cross-referenced in plate A-1.

TABLE A-4

Primary Activity Sites Located in or Near Quincy Bay

Site No.	Site Name	Ownership
1	Canton Chute	U.S. Army Corps of Engineers
2	Twin Oaks	Private
3	Bob Bangert Park	Quincy Park District
4	Quinsippi Island	Quincy Park District
5	Kesler Park	Quincy Park District
6	Quincy Boat Club	Private
7	Bicentennial Park	Quincy Park District
8	South Side Club	Private
9	All-America Park	Quincy Park District
10	Squaw Chute Marina	Quincy Park District
11	North Side Club	Private

Canton Chute is the only site in the study area which is located north and outside of Quincy Bay. It is located off a one-lane road 2 miles north of Quincy. There are no recreational facilities, except for a single ramp for launching boats. Parking is available for approximately 35 cars and trailers, but camping is prohibited. Several cottages are located along the river.

Twin Oaks is a private ramp located in the northern portion of the bay. Access is provided via a frontage road with parking on a gravel lot for approximately 20 cars and boat trailers. Recreational facilities consist of a picnic table and a private club building.

Bob Bangert Park, formerly known as Sid Simpson Park, is a multi-use park area. Facilities consist of double ramp launch facilities, 13.2 acres of soccer fields, shelter capacity for 100, and restrooms. Parking is sufficient for approximately 100 cars and trailers.

Quinsippi Park is a 130-acre recreation site located on Quinsippi Island. Access to the site is limited by a one-lane access road. During the 1970's, the island boasted a ferris wheel, miniature railroad, and sky tram. The sky tram has since been dismantled, and the ferris wheel and railroad are now in operation only for special events. Other facilities consist of two shelters which accommodate 80 to 100 people, a small playground, and a log cabin village used for sightseeing purposes. There is also a beach area along the west side of the island. Quinsippi Island is used primarily for picnicking and sunbathing.

Kesler Park, formerly known as the Quincy Public Ramp, is owned by the Park District and consists of 10.5 acres of waterfront property with an asphalt parking lot and three boat ramps. The parking lot accommodates approximately 200 cars and trailers. Facilities include a modern boat dock, restrooms, sightseeing deck, a pier for fishing, and a concession stand.

Located just south of Kesler Park, the Quincy Boat Club is a private facility consisting of a restaurant with docking facilities. A string of 41 boathouses is located between Kesler Park and the Quincy Boat Club.

Bicentennial Park, formerly the Hampshire Naval Reserve Base, is another public ramp managed by the Quincy Park District. The area site includes one ramp and a small parking area uphill of the ramp. Due to bridge construction occurring in close proximity, this ramp is experiencing limited use.

The South Side Club is a private site located at the southernmost portion of Quincy Bay. This site consists of a restaurant, picnic tables, a small playground, an access area to the river, a boat ramp, and parking facilities.

All America Park is a picnic facility located on the mainland directly across from Quinsippi Island. This 17-acre site consists of a picnic shelter, picnic tables, and restrooms. The parking area is primarily gravel, and the one-lane road to Quinsippi Island originates in this area. The Quincy Park District is planning access improvements and landscaping in this area.

Squaw Chute Marina is a fully developed marina constructed in the 1970's. It is equipped with 208 slips and 175 parking spaces. There are no ramp facilities available and no other recreational facilities except restrooms. Access to the marina is through the one-lane Quinsippi Island access road.

The North Side Club is primarily a social facility and has no access to the Quincy Bay or the Mississippi River. Trap shooting is a significant recreational activity at this site.

HISTORICAL USAGE

Quincy Bay has long served as an important source of recreation for residents of Adams County, Illinois, and neighboring counties of Lewis and Marion in Missouri. In 1974, a one-year recreational study of Pool 21, Mississippi River, was conducted by Fleener for the Missouri Department of Conservation.2/ This study used survey clerks to interview departing recreators at 24 sampling locations. Survey results indicated that approximately 386,000 visits were made to Pool 21 in that year, of which 56 percent (216,000) were to Quincy Bay. This study concluded that greater than 80 percent of all visits occurred during the summer and spring months and that 95 percent of the recreators traveled less than 25 miles to Pool 21. Nearly 88 percent of the recreators were from Illinois, with over 86 percent of these users originating in Adams County -- primarily the city of Quincy.

2/ Recreational Use of Pool 21, Mississippi River, George G. Fleener, Missouri Department of Conservation, 1975.

CURRENT USAGE

GENERAL

In 1985, the Illinois Department of Conservation contracted with Huff & Huff, Inc., to determine current recreational usage associated with Quincy Bay. Conducted from April through November 1985, the Huff and Huff study utilized a combination of exit interviews and postcard distributions to estimate current use of the facilities of Quincy Bay. The interviews solicited information regarding current recreational activities, as well as other information including historical usage of the bay, alternative sites, and use of the cut-through channel. The postcards requested income data as well.

METHODOLOGY OF RECREATION STUDY

The 1985 survey of Quincy Bay was based upon the methodology used by Fleener and the Great River Environmental Action Team (GREAT) III Study. These studies surveyed a group of sites to determine an aggregated annual usage rate for an area or region. This surveying process relies on obtaining a representative sample of usage per site over a variety of conditions, including time of day, season, and weekday versus weekend usage. For the 1985 study, survey patterns and the relative frequency of sampling at differing locations were based on results obtained during the previous survey in 1974.

Exit interviews and postcard distribution occurred between April and November 1985 at nine Quincy Bay locations. Postcards were distributed to 811 groups, while 1,260 interviews were conducted. Approximately 183 man-days of effort were utilized to collect the 2,071 observations.

To construct a representative sample at each location, the sample design specified time of day and weekday/weekend surveys for each of the spring, summer, and fall seasons. Winter usage was considered to be minor, as both the Fleener and GREAT III studies indicated that winter usage in the pool accounts for only a small percentage of annual usage (approximately 3 percent). Since the survey period did not include the winter season, winter usage was estimated based on ice fishing and trap shooting activities at the North and South Side clubs. Seasonal periods were defined as follows:

Spring	March 16 - May 31
Summer	June 1 - August 31
Fall	September 1 - December 14
Winter	December 15 - March 15

For the spring, summer, and fall periods, ratios of weekday to weekend usage and time of day distribution were developed for each site. The usage data were then translated into seasonal and annual usage rates.

Time of day intervals used for exit interviews consisted of segments from 8:00 a.m. to 8:00 p.m. At the time of completing the survey period, the clerk noted the number of cars and trailers remaining in the parking lot. This information was used to estimate the number of parties completing recreational activities between 8:00 p.m. and 8:00 a.m. of the following day. Daily a.m. use was defined as 8:00 a.m. to 4:00 p.m., while all time after 4:00 p.m. was considered to be p.m. use.

Once the seasonal data had been collected, the weights for weekday to weekend and a.m./p.m. usage were calculated for each site where more than 5 days of observation occurred. For two less frequently used sites, Bicentennial Park and Quincy Boat Club, the average ratios developed across total site data were utilized. Equations A-1 and A-2 describe the estimation of weekday/weekend and a.m./p.m. weights, respectively, for a particular season. Resulting weights are presented in table A-5.

(A-1) $$Fwy = \frac{Vwy}{5(Vwy) + 2(Vwd)}$$

$$Fwd = \frac{Vwd}{5(Vwy) + 2(Vwd)}$$

(A-2) $$Fam = \frac{Vam}{Vam + Vpm}$$

$$Fpm = \frac{Vpm}{Vam + Vpm}$$

Where

Fwy = weight for weekday usage at site
Fwd = weight for weekend usage at site
Vwy = mean weekday usage at site
Vwd = mean weekend usage at site
Fam = weight for a.m. usage at site (8:00 a.m. to 4:00 p.m.)
Fpm = weight for p.m. usage at site (after 4:00 p.m.)
Vam = mean a.m. usage
Vpm = mean p.m. usage

TABLE 5

A.M./P.M. and Weekday/Weekend Weights for Sites

Spring/Summer

	Site	Fam	Fpm	Fweekday	Fweekend
1.	Canton Chute	0.26	0.74	0.09	0.27
2.	Twin Oaks	0.27	0.73	0.13	0.16
3.	Bangert Park	0.30	0.70	0.083	0.29
4.	Quinsippi Island	0.43	0.57	0.12	0.20
5.	Kesler Park	0.24	0.76	0.09	0.275
6.	Squaw Chute Marina	0.22	0.78	0.092	0.27
	Overall	0.23	0.77	0.098	0.25

TABLE 5 (Cont'd)

Fall

Site	Fam	Fpm	Fweekday	Fweekend
1. Canton Chute	0.54	0.46	-	-
2. Twin Oaks	0.54	0.46	-	-
3. Bangert Park	0.54	0.46	-	-
5. Kesler Park	0.23	0.77	-	-
6. Squaw Chute Marina	0.23	0.77	-	-
8. South Side Club	0.23	0.77	-	-
Overall	0.34	0.66	0.109	0.23

Depending upon the recreational uses of a site, these weights would vary in importance. Utilizing these weights, estimates of weekly usage for a season were derived from the data and equation A-3:

$$(A\text{-}3)\quad Ea = \sum_{S=1}^{S=n} \frac{Vs}{(Fwy/wd)\ (Fam/pm)} \times 1/n$$

Where

Ea = expected visits per week for site A
Vs = number of visits at site for sample day
Fwy/wd = weight of weekday/weekend
Fam/pm = weight of am/pm usage
n = number of survey days for site A

After estimation of weekly usage, Ea, seasonal usage was derived by multiplying the number of weeks in the season. Seasonal usage of Quincy Bay was then estimated by summing these results across all sites. The number of trips to the bay was converted to number of recreation days by multiplying by the average number of persons in each group. From survey results this was determined to be 2.95 persons, which is consistent with GREAT III results of 2.86 persons per group.

SURVEY RESULTS

Table A-6 summarizes annual days of recreation occurring by season for each Quincy Bay site. These values are based on an estimated number of trips and an average number of 2.95 persons per party. Quincy Bay provided over 180,000 days of recreation with the majority of activity occurring in the spring and summer.

TABLE A-6

Annual Days of Recreation in Quincy Bay Area

Site	Spring/ Summer	Fall	Winter	Total Visits	Standard Error
Canton Chute	7,860	970	-	8,830	1,090
Twin Oaks	6,490	2,450	-	8,940	2,080
Bangert Park	24,300	5,570	-	29,870	2,250
Quinsippi Is.	32,320	3,540	-	35,860	4,810
Kesler Park	35,260	6,040	-	41,300	3,940
Squaw Chute	21,240	5,580	-	26,820	3,920
All America	1,260	-	-	1,260	-
North Side	-	-	1,800	1,800	-
Cottage Use	11,800	4,100	1,200	17,100	-
Other Sites 3/	6,190	1,420	600	8,210	1,130
Total	146,720	29,670	3,600	180,000	8,100

Kesler Park is the site of greatest usage owing to its multi-ramp facilities and improvements made by the Quincy Park District. This site accounted for 22.9 percent of all recreation in the bay. Quinsippi Island, which is used primarily for picnicking and sunbathing, provided 19.9 percent of all visits. Bob Bangert Park, which provides an access point to the bay for fishermen and hunters, recorded 16.6 percent of the visits. Squaw Chute Marina was fourth in activity with 14.9 percent of the visits. Together, these four sites accounted for 74.3 percent of the visits to the bay.

Cottage use along Quincy Bay represents another important source of recreation, accounting for 9.5 percent of annual days of recreation. Twenty-four cottages are located along the bay. These are located from Twin Oaks to the northernmost reaches of the bay. Access to the cottage area is possible utilizing a frontage road and private drive for those cottages at the northern end of the bay. Fifty-four percent (13) of the cottage owners were interviewed, revealing that 77 percent of the respondents used the cottages permanently, 15 percent used them on a weekly basis, and 8 percent used them seasonally. Boating, fishing, and nature observation were the primary recreational activities of cottage owners.

The 1985 seasonal usage pattern corresponds quite closely to that of the 1973-1974 Pool 21 study. The comparison of seasonal usage on a percentage basis is presented in table A-7. Survey results indicate that 50 percent occurs during the week during spring and summer. During the fall, the weekday activity accounts for 54 percent of use while weekends are only 46 percent. This slight shift can be attributed to waterfowl hunting which occurs on weekdays and weekends.

3/ Includes South Side Boat Club, Quincy Boat Club, and Bicentennial Park

TABLE A-7

Historical and Current Seasonal Usage at Quincy Bay
(percent)

Season	1974 Survey	1985 Survey
Spring/Summer	81.5	81.5
Fall	15.6	16.5
Winter	2.9	2.0

Historical and current visits as a percentage of total visits to Quincy Bay recreational sites are presented in table A-8.

TABLE A-8

Historical and Current Visits to
Quincy Bay Recreation Sites
(percent of total)

	Site	1974 Survey	1985 Survey
1.	Canton Chute	14.0	5.5
2.	Twin Oaks	7.0	5.4
3.	Bob Bangert Park	18.0	18.5
4.	Quinsippi Island	14.0	22.2
5.	Kesler Park	28.0	25.6
6.	Quincy Boat Club	3.0	0.5
7.	Bicentennial Park	7.0	0.7
8.	North Side Club	2.0	1.1
9.	South Side Club	7.0	3.9
10.	Squaw Chute Marina	0.0	16.6

Boating is the primary recreational activity occurring in Quincy Bay, representing over 40 percent of total activity days. As defined, one activity day is counted for each activity named by a respondent. Therefore, there are more activity days associated with Quincy Bay than recreators. Approximately 246,000 activity days occurred, while only 180,000 visits were estimated. Boating, fishing, swimming, and waterskiing account for 80 percent of the bay's recreation. Other major activities include picnicking, duck hunting, sightseeing, sunbathing, and tubing. A breakdown of activity days occurring in Quincy Bay and the Mississippi River are presented in table A-9.

TABLE A-9

Activity Days in Quincy Bay Area

Activity	Activity or User Days
Boating	107,600
Fishing	36,200
Swimming	33,500
Waterskiing	21,900
Picnicking	6,900
Duck Hunting	4,700
Sightseeing	4,400
Cabin Use	1,500
Camping	1,500
Hiking	1,500
Canoeing	1,200
Nature Observation	1,200
Hunting	1,200
Biking	700
Gathering	200
Other	21,900
Total	246,100

In 1974, boating also was the most popular activity, with fishing the second most popular. Cottage use, which was a primary activity in 1974, was a minor factor in 1985 usage.

During the summer, the main stem and islands in the Mississippi River account for 77 percent of the activity. Only 11 percent of the recreators use the immediate bay area, and approximately 12 percent recreate in the backwaters of the bay. Backwater activities include waterskiing, fishing, hunting, and boating. During the fall season, Quincy Bay is more heavily utilized (36 percent) by hunters and fishermen. The Mississippi River still accounts for 64 percent of the recreation.

Survey results indicate that Quincy Bay is acting primarily as an access site for a large fraction of the recreational use occurring in the area. Only 84,200 of the estimated total 246,000 user days occur in the bay itself, and only 31,200 of these are classified as water-based recreational activities. Water-based recreation consists of the 23,300 user days in the spring/summer and 7,900 user days in the fall associated with activity by recreators utilizing the public/private boat access points. Added to these water recreation days, total bay usage also includes the 17,100 user days of cottage residents and the 35,900 user days associated with Quinsippi Island.

SECTION 3 - EVALUATION OF ALTERNATIVES

GENERAL

Benefits arising from recreational opportunities created by a Federal project are measured in terms of willingness to pay. Benefits for projects (or project features) that alter willingness to pay (e.g., through quality changes) are measured as the difference between the without- and with-project willingness to pay. Benefits for projects (or project features) that increase supply are measured as the willingness to pay for each increment of supply.

For this analysis, recreational benefits were measured using the unit day value method of recreational benefit assessment. This method relies on expert or informed opinion and judgment to estimate the average willingness to pay of recreational users. Through application of a unit day value to estimated use, an approximation is obtained that may be used as an estimate of project recreational benefits. As applied in this analysis, a point value is assigned to the existing recreational experience. This point value is then converted into a dollar value per activity day or visitor. A point value also is assigned to the recreational experience as perceived with the project or project feature. The resulting difference between the two dollar values represents the benefits to be realized from the project.

In general, the point values assigned to recreational activities in Quincy Bay utilizing the unit day value method are relatively low under both the without- and with-project conditions. This is due to the low aesthetics associated with the sediment-laden bay as well as the local availability of alternative sites, in most cases, for boating, fishing, and waterskiing.

A number of alternatives were evaluated to enhance the recreational potential of the Quincy Bay area: (1) selective dredging of Upper Quincy Bay; (2) dredging of Broad Lake with construction of a levee across Bay Island; (3) restriction of the access channel; and (4) expansion of the existing small-boat harbor.

ALTERNATIVE 1 - SELECTIVE DREDGING OF UPPER QUINCY BAY

PROJECT DESCRIPTION AND COSTS

This alternative consists of dredging approximately 65 acres of upper Quincy Bay to establish and maintain a recreational boating and waterskiing area 5 feet in depth (plate 19). This depth will provide adequate conditions for waterskiing and boating. Dredged material would be spoiled on a 52-acre site located at the lower end of the Indian Grave Drainage District. Based on a dredging/disposal cost of $3.00 per cubic yard, the first cost

of this alternative is estimated at $1,068,000, with maintenance dredging to be required every 15 years at a cost of $624,000. Using a 50-year project life and an 8-7/8 percent discount rate, equivalent annual costs of this alternative are equal to $117,400.

PROJECT BENEFITS

At one time, upper Quincy Bay provided an important source of waterskiing and recreational boating opportunities. Continued sediment accumulation in the bay, however, has resulted in deterioration of the quality of this resource. Water depths are generally less than 3 feet at flat pool in this portion of the bay, which is considered inadequate for high quality power boating and other activities. Presently only a few recreators utilize this portion of the bay for boating or waterskiing. Most boaters and waterskiiers have moved to other locations, primarily the main channel of the Mississippi River and East Chute located upstream of the upper bay. Local waterskiing clubs still use this portion of the bay, however, and fully support its rejuvenation.

Benefits to be derived from selective dredging of the upper bay were estimated based upon the difference between the value of recreational activity "without dredging" and "with dredging." It is assumed that by the base year (1992), continued sediment accumulation will have halted all waterskiing in the upper bay. As a result, all waterskiing that is expected to occur after dredging can be attributed to the project.

Based upon field survey and discussions with Federal and local officials familiar with recreational opportunities in the Quincy Bay area, a total of 45 points can be assigned as the value of a recreation experience (waterskiing) subsequent to dredging of the upper bay (refer to table A-10). This point value translates to a dollar value of $3.45 per visit. It is estimated the proposed recreational area of 65 acres is capable of supporting approximately 7,000 waterskiiers per year.[4/] Using this estimate of annual recreators, annual benefits of this alternative are obtained by multiplying the point value per visit by the number of annual waterskiiers. Thus, annual benefits accruing to enhanced waterskiing conditions are equal to $24,200 (7,000 annual waterskiiers times $3.45 per visit).

4/ Estimates based on 10 required acres per boat, 4 persons per boat, turnover of 4 times per day on weekends, 16-week season, and weekday utilization rate approximately one-third that of weekend rate. Source: Master Plan Design Memorandum 6B, Saylorville Lake, Appendix B, September 1984.

TABLE A-10

Unit Day Value Point Value Assignment for General Recreational Waterskiing Experience (With Project Conditions)

Criteria	Point Assignment	Comments
Recreation experience	11	One high quality activity
Availability of opportunity	14	None within one hour (backwater area)
Carrying capacity	6	Adequate facilities
Accessibility	8	Fair access to site
Environmental quality	6	Average aesthetics somewhat lowered by siltation
Total Points	45	

The activities of local ski clubs provide another significant source of benefits to be derived through selective dredging of the upper bay. Local ski clubs perform exhibitions there several times each year for various charities. Local officials state that such events are well attended (averaging approximately 2,000 people per event) and that attempts to relocate the exhibitions have not been fully successful. As many as eight events may be held each year. Without Federal action, it is assumed that this portion of the bay will no longer be suitable for such exhibitions by the base year. With a Federal project, however, these events will continue. Using the unit day value method as presented in table A-11, it is estimated that the point value of attendance at these exhibitions is 35, which can be converted to $2.95. Assuming annual attendance of 16,000 persons with a value per spectator of $2.95, results in annual benefits of $47,200.

TABLE A-11

Unit Day Value Point Value Assignment for
Waterskiing Exhibition Experience
(With Project Conditions)

Criteria	Point Assignment	Comments
Recreation experience	8	Several general activities
Availability of opportunity	15	None within 2 hours
Carrying capacity	4	Basic facilities
Accessibility	4	Restricted access throughout site
Environmental quality	4	Average aesthetics lowered by confined waterskiing area
Total Points	35	

Although a 5-foot depth is not considered optimal for development of a good fishery, dredging to this depth will nonetheless provide some benefits to local fishermen. Fishing in this area will be further hindered by waterskiing activities anticipated to occur subsequent to dredging. As a result, fishing will only be possible during times of the year when there is no waterskiing. It is estimated that approximately 1,500 fishermen will utilize this area each year following its deepening. At a value of $2.47 per visit (refer to table A-12), annual benefits accruing from increased fishing in upper Quincy Bay following project construction are equal to $3,700. Thus, total benefits to be realized through selective dredging of upper Quincy Bay are equal to $75,100 ($24,200 + $47,200 + $3,700).

ALTERNATIVE 2 - DREDGING OF BROAD LAKE WITH CONSTRUCTION OF MISSISSIPPI LEVEE

DESCRIPTION AND COSTS OF ALTERNATIVE

This alternative consists of dredging approximately 31 acres of lower Broad Lake to enhance its environmental quality and recreational potential. The area would be dredged to a 10-foot depth to provide conditions suitable for a good fishery. The dredged material would be used to construct a 12,000-foot levee along the Mississippi River from the Indian Grave Drainage District Levee to the Burlington Northern Railroad embankment (plate 20). Since Mississippi River flood flows are responsible for

the majority of sediment deposition into Quincy Bay, it is anticipated that the levee would reduce the rate of sedimentation in the bay by approximately 50 percent. Total first costs of the project are estimated at $2,537,000, with maintenance costs of $300,000 to be incurred every 10 years. Annual maintenance for the levee is estimated at $2,000. Using an 8-7/8 percent discount rate and a 50-year period of analysis, equivalent annual costs of this alternative are equal to $249,900.

BENEFITS ASSOCIATED WITH ALTERNATIVE

Broad Lake was first deepened in 1960, resulting from its use as a borrow site for construction of the new railroad bridge across the Mississippi River. Following its excavation, the site was heavily utilized for fishing. Continued sediment accumulation has filled in the area, so that it is generally less than 2 feet in depth. Currently, little or no fishing occurs in lower Broad Lake. Dredging of lower Broad Lake to a depth of 10 feet, in combination with construction of a Mississippi levee, will provide various benefits, including formation of a good fishery in Broad Lake as well as reduced sediment accumulation into the bay. A reduction in sedimentation will provide a general benefit to the entire bay by prolonging its life and lowering potential maintenance costs in those areas where the Federal Government has dredging responsibilities.

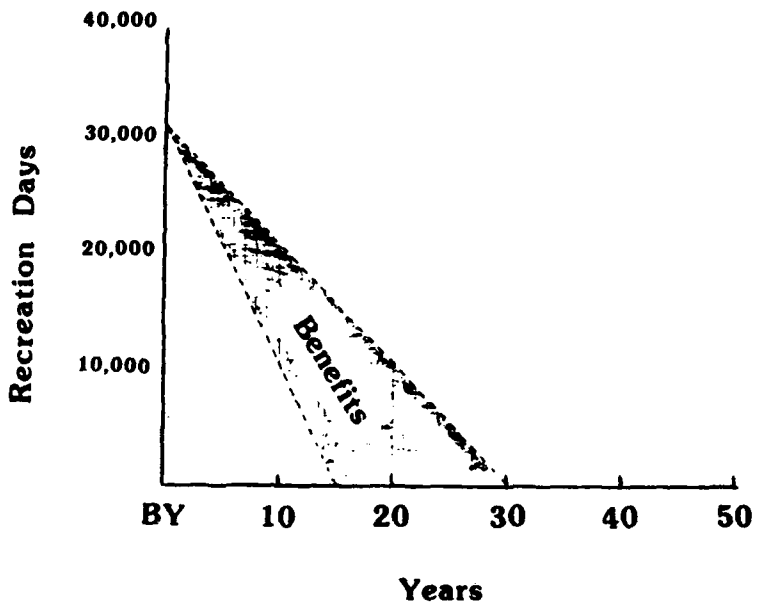
Since little or no activity is presently occurring in Broad Lake, it is assumed that no activity will be occurring by the base year (1992). With Federal action, however, it is estimated that approximately 2,500 fishermen will use this portion of the bay annually.5/ Using the unit day value method, it is estimated that the value of these recreational days will be equal to $2.47, based on a point value derivation presented in table A-12. When multiplied by the number of annual fishermen using this site, annual benefits are equal to $6,200.

Construction of the levee is expected to reduce the rate of sediment accumulation into the bay by 50 percent. As a result, this alternative will provide benefits to all water-based recreators in the bay (approximately 31,200) as the life of the bay will be prolonged. It is assumed that the levee will extend the water-based life of the bay from 15 years to 30 years beyond the base year as depicted in figure A-1. It is further assumed that under the without-project condition, the number of water-based recreation days in the bay will decrease in a linear fashion from an annual number of 31,200 in the base year to nearly zero over the remaining life of the bay. Using a dollar value per visit of $2.32 as derived in table A-13, equivalent annual benefits represent the difference in benefits under with- and without-project conditions over the remaining life of the bay. These are equal to $15,600.

5/ Based on usage at Big Timber Wildlife Refuge, Pool 17, UMR.

FIGURE A-1

Graphical Illustration of Benefits Derived from Prolonged Longevity of Quincy Bay



Construction of the levee also is anticipated to result in reduced maintenance requirements for those areas of the access channel and middle and lower bay where the Federal Government has maintenance obligations. Maintenance requirements are expected to be reduced by 50 percent, thereby reducing annual potential maintenance expenditures for the access channel by $8,400 and middle and lower Quincy Bay by $7,000 for a total of $15,400. Thus, total equivalent annual benefits to be realized through this alternative are equal to $37,200 for all categories of benefits ($6,200 + $15,600 + $15,400).

TABLE A-12

Unit Day Value Point Value Assessment for
Fishing in Lower Broad Lake
(With Project Conditions)

Criteria	Assignment	Comments
Recreation experience	1	One general activity
Availability of opportunity	6	None within 30 minutes
Carrying capacity	6	Basic facilities
Accessibility	6	Limited access within site
Environmental quality	4	Average, lowered by some factors
Total Points	23	

TABLE A-13

Unit Day Value Assessment for
General Recreation in Quincy Bay
(Existing Conditions)

Criteria	Point Assignment	Comments
Recreation experience	5	Several general activities
Availability of opportunity	11	None within 1-hour travel time
Carrying capacity	1	Minimum facilities
Accessibility	1	Limited access within site
Environmental quality	1	Water depth lowers quality
Total Points	19	

As conceived, construction of the levee would necessitate the closure of the access channel across Bay Island. This would result in significant disbenefits to local recreational craft that utilize the channel as a shortcut to the main channel. Nearly 64 percent of the boats use the access channel during the spring/summer season and 58 percent use the channel during the fall. Since these disbenefits do not affect the outcome of this alternative and only act to lower the benefit-to-cost ratio, they were not considered at this level of the study.

Dredging of lower Broad Lake can be expected to provide an enhanced environment for all aquatic species, including fish, waterfowl, small furbearers, reptiles, amphibians, and aquatic plants. Although these benefits are not directly quantifiable, it is believed that benefits associated with improved fishing in the localized area act as an acceptable proxy for these benefits.

ALTERNATIVE 3 - RESTRICTION OF ACCESS CHANNEL

DESCRIPTION AND COSTS OF ALTERNATIVE

The access channel is a 6,400-foot channel cut across Bay Island to provide small boats convenient access to the Mississippi River channel. The project was designed to have a bottom width of 50 feet with side slopes of 3 horizontal on 1 vertical and depth at flat pool elevation of 5 feet plus 1 foot overdraft. The channel has since scoured to a much larger cross-sectional area than originally designed in the upper end of the access channel.

When originally constructed in 1969, the access channel was designed to permit recreational craft to shorten their route to the main channel from origins and destinations in the lower and upper bay, rather than navigate around the downstream tip of Quinsippi Island. According to the Detailed Project Report submitted in 1969, annual benefits of the project were equal to $6,700, based on fuel savings of boaters using the shorter route via the access channel. For boats originating in the lower portion of the bay, the route to the main channel was shortened by 0.871 miles. For those craft originating in upper Quincy Bay, the route was shortened by 2.0 miles. Eighty (80) percent of the benefits were derived from boats originating or destined to the upper bay locations (that above the railroad bridge).

As proposed under this alternative, a submerged weir would be constructed on the bottom of the scoured access channel in the upper end of the Bay Island access channel (plate 20). This weir would permit recreational navigation but limit water and sediment flow through the channel. The structure would act to prevent Mississippi River bedload sand from entering the access channel. It is anticipated that construction of the weir would reduce the rate of sedimentation into lower Broad Lake, the lower access channel, and Middle and Lower Quincy Bay. The total first cost of this

alternative is $207,000, with estimated annual maintenance costs of $5,000. Total equivalent annual costs of this alternative are equal to $23,600, based upon a 50-year project life and an 8-7/8 percent discount rate.

BENEFITS ASSOCIATED WITH ALTERNATIVE

Benefits associated with this alternative are based on the potential reduction in dredging volumes afforded by the weir. These dredging costs also may represent a proxy for the economic costs associated with continued siltation.

It is estimated that flow through the access channel annually deposits as much as 30,500 cubic yards of bedload sand into Quincy Bay. Construction of the submerged weir is anticipated to reduce this volume by 50 percent. Based on $5.00 per cubic yard, this equates to $76,250 in potential reduced dredging costs. A more conservative estimate, however, and one which is based on historical sedimentation rates in these portions of the bay, results in potential savings of $25,800, or a potential reduction in annual dredging volumes of 5,150 cubic yards.

A possible negative consequence of this alternative is that the submerged weir section could produce turbulence at certain flows and possibly become a hazard to recreational craft attempting to pass over the control structure. Further study would be necessary to evaluate this impact.

ALTERNATIVE 4 - EXPANSION OF SMALL-BOAT HARBOR

DESCRIPTION AND COSTS OF ALTERNATIVE

This alternative involves expanding the existing marina on Quinsippi Island. The expansion would be located just north of the existing Squaw Chute Marina and include an area 900 feet long and 200 feet wide and would be dredged to a depth of 5 feet (plate 22). The total first cost of the expansion is estimated at $798,000, with annual maintenance costs of $3,500. Using a 50-year project life and an 8-7/8 percent discount rate, equivalent annual costs of this alternative are equal to $75,300.

BENEFITS ASSOCIATED WITH ALTERNATIVE

Benefits associated with this alternative include increased availability of marina facilities for area boaters. Through expansion of the existing marina, those boaters currently on the waiting list and those future boaters desiring to use marina facilities will be able to do so. It is anticipated that one-half of the boaters utilizing the new facility will be new boaters, and the balance will consist of those boaters who are currently trailering their boat to the bay. Using the unit day value method of recreational value assessment, the value of a boater experience

who is already trailering his boat is estimated to equal $2.26. For new boaters who are able to utilize the expanded marina facilities, this value is expected to equal $2.83 for an incremental difference of $0.57.

Expansion of the existing marina is expected to result in a potential availability of 200 additional slips. There is currently a waiting list of about 50 boaters for slip facilities, with demand expected to increase to as many as 100 by the base year. From previous studies 6/, it has been determined that an average boater will use his boat 21 times per year with an average of 3 persons per boating party. Using these data and a base year increase of 100 boaters, average annual benefits are equal to $10,700. 7/ Assuming that demand increases in a linear fashion until all slips are filled in the year 2000, results in future annual benefits of $7,100. Thus, total annual benefits of marina expansion are equal to $17,800.

OTHER ALTERNATIVES

A final alternative investigated in this analysis consisted of the complete closure of the access channel across Bay Island. This alternative is similar in cost to that of the submerged weir, but would be more effective in reducing the amount of bedload sand and other sediment being transported into this portion of the bay. Although the amount of sediment deposition would be reduced under this alternative, these benefits would be far exceeded by the negative impacts to recreation craft which are currently utilizing the channel. These craft would be forced to navigate around the downstream tip of Quinsippi Island in order to access the main channel of the Mississippi River, thus incurring greater travel distances and longer travel time. According to 1985 survey data, nearly 64 percent of the boats use the access channel during the spring/summer season and 58 percent use the channel during the fall. Due to the magnitude of disbenefits associated with complete closure of the access channel, this alternative was not pursued further.

SUMMARY OF ANNUAL BENEFITS AND COSTS OF ALTERNATIVES

SUMMARY OF RESULTS

A summary of annual benefits and costs of the alternatives are presented in table A-14. All costs were computed using a 50-year project life and an 8-7/8 percent discount rate.

6/ Source: Previous District Section 107 studies

7/ 100 boats x 21 annual trips x 3 persons per party x [(0.5) ($2.83 + $0.57)].

TABLE A-14

Summary of Annual Benefits and Costs of Alternatives

Benefit Category	Alt. 1 ($)	Alt. 2 ($)	Alt. 3 ($)	Alt. 4 ($)
Enhanced waterskiing	24,200			
Enhanced fishing	3,700	6,200		
Enhanced general recreation	47,200	15,600		
Reduced dredging costs		15,400	25,800 8/	
Enhanced boating				
-existing				10,700
-future				7,100
Total Annual Benefits	75,100	37,200	25,800	17,800
Total Annual Costs	117,400	249,900	23,600	75,300
BCR	0.64	0.15	1.09 8/	0.24

8/ Reflects most conservative level of benefits

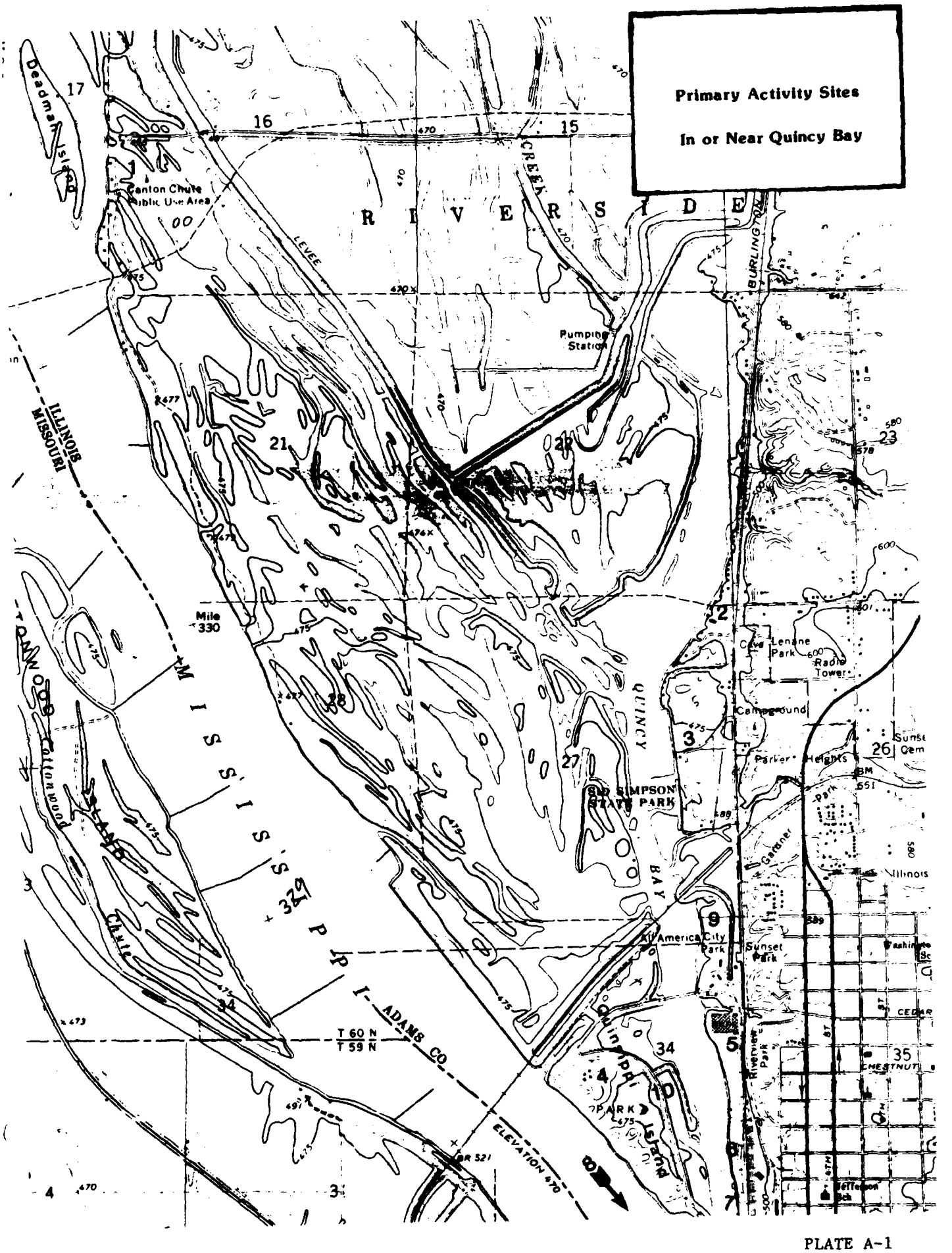

Primary Activity Sites
In or Near Quincy Bay
Beadman Island
Canton Chute Public Use Area
RIVERSIDE
CREEK
BURLINGTON
LEVEE
Pumping Station
ILLINOIS
MISSOURI
Mile 330
MISSISSIPPI
Cottonwood Island
Chute
QUINCY BAY
SID SIMPSON STATE PARK
All America City Park
Sunset Park
Lenane Park
Radio Tower
Campground
Parker Heights
Gardner Park
Riverview Park
Quincy Island
ADAMS CO.
T 60 N
T 59 N
ELEVATION 470
CEDAR
CHESTNUT
Illinois

PLATE A-1

APPENDIX B

PERTINENT CORRESPONDENCE

RECONNAISSANCE REPORT
SEDIMENTATION PROBLEM

QUINCY BAY, ILLINOIS

APPENDIX B
PERTINENT CORRESPONDENCE

TABLE OF CONTENTS

96th Congress

2nd Session

United States Senate

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

COMMITTEE RESOLUTION

RESOLVED BY THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS OF THE UNITED STATES SENATE,

that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on the Mississippi River between Coon Rapids Dam and the mouth of the Ohio River as published in House Document No. 669, 76th Congress, 3rd Session, with a view to determining whether any modifications in the recommendations are advisable to alleviate the siltation problems on the Mississippi River upstream of mile 300, particularly at the Quincy Bay and Broad Lake and Triangle Lake, Illinois, in the interest of navigation, recreation, fish and wildlife, and other purposes, where such measures contribute to improvements in national economic development and environmental quality.

Jennings Randolph
CHAIRMAN

RANKING MINORITY MEMBER

Adopted: 12/5/80

(at the request of Senator Daniel Patrick Moynihan, New York)

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, D.C. 20314

ER 1165-2-119

DAEN-CWR-R

Regulation
No. 1165-2-119

20 September 1982

Water Resources Policies and Authorities
MODIFICATIONS TO COMPLETED PROJECTS

1. Purpose. To coalesce guidance on the use of available authorities, as compared to the need for new project authorizations, for study and accomplishment of modifications to completed projects.

2. Applicability. This regulation applies to all Headquarters, USACE elements and all field operating activities (FOAs) having Civil Works responsibilities.

3. References.

a. Section 216 of the Flood Control Act of 1970.

b. ER 1105-2-10 (Chapter 4)

c. ER 1105-2-20 (Chapter 7)

d. ER 1110-2-240

e. ER 1130-2-334

f. ER 1130-2-417

4. Definitions.

a. Original project development. Planning, land acquisition, design and construction which fulfilled the initial project authorization requirements (plus, if applicable, similar accomplishments for any subsequently completed project modifications).

b. Completed project. A project, or separately funded portion of a project, is considered complete when any one of the following conditions is met:

(1) When contracts, or hired labor activities, for all work included in the plan of improvement contemplated when final appropriations were made by Congress have been physically completed.

(2) Same as (1) above, except that a determination was made that some element of work was not required.

(3) More than two years have elapsed since the year completion funds were appropriated and only minor work items remain to be completed.

c. Project modifications. Changes in project operation, change in real estate interest, physical change of a project feature, the addition of project features, or changes in the purposes of a project.

5. General. Significant modifications to completed projects - modifications which involve new Federal construction or real estate acquisition in order to serve new purposes, to increase the scope of services to authorized purposes beyond that intended at the time of project construction, or to extend services to new beneficiaries (areas) - require authorization by Congress. Ordinarily, such authorization is achieved through the General Investigations program as a consequence of a feasibility (survey) report submitted to Congress in response to a specific directive from the Congress, usually in recognition of local interests' perceptions of needs. It is, however, a general policy of the Chief of Engineers that completed Corps projects be observed and monitored by the Corps to ascertain whether they continue to function in a satisfactory manner and whether potential exists for better serving the public interest. Such monitoring may be accomplished coincidentally in carrying out existing project inspection programs, as a by-product of contacts with local interests and other Federal agencies, and through the day-to-day observations of on-site Corps personnel charged with project operations. Whenever reporting officers find that changes in a completed project may be desirable, investigations should be undertaken to document the need for and feasibility of project modification. To the extent possible, modifications to completed projects should be accomplished under existing authorities. Pertinent existing authorities are discussed in paragraphs 6 through 10. If a needed modification cannot be accomplished using these authorities, additional authorization must be sought as discussed in paragraphs 11 and 12.

6. Modification Under Existing Authority, General.

a. Project authority. Project authorizations may provide authority for the Chief of Engineers to modify project operation or facilities to account for conditions expected at a future date. Because of the range of authority which may be available in project authorizations, it is not possible to detail the modifications which may be undertaken in this manner. Prior to proposing modifications using other authorities, reporting officers should thoroughly review the legislative history and related project documents for the individual project of concern to determine if sufficient authority already exists within the specific project authorities.

b. Project deficiencies. Occasionally, a project may deserve modification because its original development was inherently deficient. Given certain conditions and qualifications, measures to correct such deficiencies may be undertaken. This subject is covered in detail in paragraph 7 in connection with completed projects that are operated and maintained by local interests. The criteria set forth for modifications to correct deficiencies

in such projects are also generally applicable to projects operated and maintained by the Corps.

7. Modification Under Existing Authority, Local Protection Projects. The general rule is that Federal construction and funding authorities cease once a project is transferred to local interests for operation and maintenance. Thus in most cases additional Congressional authorization is required for any proposed Federal work associated with completed local protection projects. An exception is for work to correct design or construction deficiencies (see, also, paragraph 8b). A design or construction deficiency is a flaw in the Federal design or construction of a project that significantly interferes with the project's authorized purposes or full usefulness as intended by Congress at the time of original project development. Corrective action, therefore, falls within the purview of the original project authority. Project modifications which can appropriately be undertaken without further authorization, to correct project deficiencies, are discussed below:

a. Eligible works. Works proposed to correct a design or construction deficiency may be recommended for accomplishment under existing project authority without further Congressional authorization if the proposed corrective action meets all of the following conditions:

(1) It is required to make the project function as initially intended by the designer in a safe, viable and reliable manner; e.g., pass the original design flow without failure. This does not mean that the project must meet present-day design standards. However, if current engineering analysis or actual physical distress indicates the project will fail, corrections may be considered a design or construction deficiency if the other criteria are met.

(2) It is not required because of changed conditions.

(3) It is generally limited to the existing project features. Remedial measures which require land acquisitions or new project structures must not change the scope or function of the authorized project.

(4) It is justified by safety or economic considerations.

(5) It is not required because of inadequate local maintenance. Local responsibilities for maintenance of local protection projects are stated in 33CFR208.10.

b. Ineligible works. A project may be considered or described as deficient for many reasons; however, a project deficiency is not correctable without further Congressional authorization unless it is a product of Federal engineering or construction efforts related to express project purposes. While a project may be deficient because it does not satisfy or fulfill contemporary needs, the deficiency is not a design or construction deficiency if it results from causes external to the project design or construction effort. Examples of external causes are: inadequate operation and maintenance by local interests; changed development in the project area (e.g.

shift from agriculture to urban uses, making a higher degree of protection desirable); increased runoff efficiency of the watershed (e.g. as a consequence of upstream urban development or other land clearing practices which may tend to reduce the degree of protection of the project); and other non-project-related changes in the river regimen (e.g. alteration of the natural aggradation, degradation, or meandering processes). Note: if project development failed to properly account for the natural river processes and project associated changes to those processes, a design or construction deficiency is usually indicated. Construction to correct a design or construction deficiency should be limited to the necessary corrective work and should be consistent with original project purposes at the time of initial construction; such corrective work will not be undertaken or extended to expand or change the authorized scope, function, or purpose of a project or to modernize an otherwise soundly constructed project.

c. Justification and cost sharing. The proposed corrective work should be justified incrementally by current economic considerations (future project costs and benefits; the sunk costs for the original project development excluded) unless it is otherwise shown that the work is necessary for safety reasons. Cost sharing for correction of design or construction deficiencies should be consistent with the cost sharing in the original project authorization.

Consideration of modifications under this authority allows for correction of design or construction deficiencies regardless of their period of discovery and does not limit the scope of inquiry to considerations of "state of the art technology" or fault at the time of construction. Recommendations for proposed work to correct design and construction deficiencies (in other Corps projects as may be deemed appropriate as well as in local protection projects as discussed above) should be addressed to CDR USACE (DAEN-CWO-M) WASH DC 20314.

8. Modification Under Existing Authority, Multiple Purpose Projects.

a. Operations and maintenance authority. For projects operated and maintained by the Corps, the Corps responsibility for acceptable management of the project to serve the public interest confers a broad authority for making, as part of its operations and maintenance efforts, reasonable changes and additions to project facilities within the project boundaries as may be needed to properly operate the project or minimize maintenance. This may include, if appropriate, change in existing Federal real estate interest; it does not include acquisitions in detached areas where Federal real estate interest was not acquired for the original project development. There are, in addition, several specifically recognized ways in which projects operated and maintained by the Corps may be modified within existing authorities. These are discussed in the following subparagraphs.

b. Dam safety assurance. This program has been established to provide for modification of Corps dam projects which are considered to have potential safety hazards in light of present-day standards and knowledge. The program

is intended to facilitate upgrading of those project features with deficiencies related to dam safety that are within the Chief of Engineers discretionary authority and cannot be corrected under other funding programs (i.e., programs for routine maintenance or for rehabilitation to permit continued effective operation of a project as it was originally intended to function). In addition to certain kinds of structural works, modifications under this particular program may extend to acquisition of new real estate interest downstream of spillways if existing interest is inadequate relative to the safety criteria of ER 1110-2-1451. Guidance regarding the kinds of work eligible for funding and implementation under the dam safety assurance program is provided in ER 1130-2-417. Except that any needed change in real estate interest would remain the responsibility of local interests, this program is equally applicable to Corps-constructed dams which serve as local protection projects, or elements thereof, and have been turned over to local interests for operations and maintenance.

c. Changes in water control plans. Authorities for the allocation and regulation of reservoir storage in projects operated by the Corps are in the acts authorizing the projects. Proposed changes in water control plans must be carefully reviewed to determine the extent of change which may be undertaken consistent with the authorizing legislation. With some specific exceptions, revised plans for purposes not encompassed by the existing project authority require new Congressional authorization. Futher Congressional authorization is not required to add municipal and industrial water supply, water quality, and recreation and fish and wildlife purposes if the related revisions in regulation would not significantly affect operation of the project for the originally authorized purposes. Often proposals for changes in regulation, whether to alter the services provided in terms of originally authorized purposes or to add new purposes, contemplate increases in length of time waters are stored at various levels in the reservoir. Such proposals may require upgrading of interests in reservoir lands on which flowage easements were obtained. The impacts of these factors along with all other benefits and costs should be considered in any decision to change a water control plan. Policies and procedures regarding development of water control plans are contained in ER 1110-2-240.

d. Addition of water supply. Pursuant to the Water Supply Act of 1958, reallocation of reservoir storage to add water supply (as a purpose) to a completed project may be undertaken under the Chief's discretionary authority when it will have no significant effect on other authorized purposes and will involve no major structure or operational change. In addition, local interests and adjacent or nearby property owners may be allowed under license, granted for an administrative charge, to install facilities across project lands to withdraw minor amounts of water for which storage is not required and which does not affect project purposes. (This does not constitute a water supply "purpose.") Policies concerning the modification of a project to serve water supply functions are described in ER 1105-2-20 (Chapter 7).

e. Changes to meet water quality needs. Although water quality legislation does not require a permit for discharges from reservoirs,

downstream water quality standards should be met whenever feasible. Existing projects should be evaluated and reported in accordance with ER 1130-2-334, and those found incompatible with state standards (or which otherwise are not meeting their potential to best serve downstream water quality needs) should be studied in detail to determine the justification for upgrading releases and to establish an appropriate course of action. Recommendations to modify a project for water quality reasons must be based on thorough analyses to insure that the best uses are made of the available resources. The analyses should include effects on project purposes, technical feasibility, environmental considerations, reasonableness of alternative actions, and economic impacts. Any action proposed by the Corps should be on the basis that it is engineeringly feasible, environmentally and socially acceptable, and related costs are justified on the basis of combined national economic development (NED) and environmental quality (EQ) effects. Proposals to modify projects for water quality reasons should be submitted to CDR USACE (DAEN-CWE-HW) WASH DC 20314. Upgrading of sanitary facilities at project recreation areas to meet state standards will be accomplished under the Code 710 program (see the following subparagraph).

f. Recreation and fish and wildlife enhancement. Pursuant to Section 4 of the Flood Control Act of 1944, as amended, the addition of facilities for recreation and fish and wildlife may be undertaken on project lands. Procedures for such development are provided in annual program guidance on Recreation Facilities at Completed Projects, Code 710 Program. This program is applicable to all completed projects, regardless of whether recreation was included as a purpose in the original project development, including projects encompassing recreational development under the terms of the Federal Water Project Recreation Act, 9 July 1965 (Public Law 89-72). For projects authorized prior to 9 July 1965 without recreation as a project purpose, recreation developments under Code 710 may include limited acquisition of additional lands beyond the existing project boundaries if needed to afford a project recreation area. Justified fish and wildlife facilities to enhance recreation may be developed on project lands under this program, but not mitigation measures (which, if they cannot be undertaken within the general operations and maintenance authority, require new Congressional authorization). Local interests will be required to contribute 50 percent of the development costs and assume operations and maintenance of Code 710 facilities; except that for those projects less than 60 percent completed as of 7 March 1974 their contribution toward development costs of fish and wildlife enhancement components need only be 25 percent. In the absence of a cost-sharing sponsor additional facilities will not be provided regardless of whether increased levels of visitation indicate a demand therefor, except for sanitary facilities. Sanitary facilities may be up-graded under the Code 710 program, at full Federal cost, if this is necessary to adequately serve visitation or meet state water quality standards. Also, existing facilities originally provided at full Federal expense and subsequently degraded as a consequence of public use may be rehabilitated without cost-sharing (with operations and maintenance funding; not Code 710). Questions regarding the Code 710 program reporting and funding procedures should be addressed to CDR USACE (DAEN-CWO-R) WASH DC 20314.

9. Modification Under Existing Authority, Navigation Projects. The Chief of Engineers has but limited discretion with respect to modification of completed navigation projects without new authorization. The River and Harbor Act of 1909 provides (Section 6) an authority for complete reconstruction of aged or outmoded lock and dam structures on authorized waterways and is permissive to modifications (in the replacements) to better serve navigation. This permits the Corps to study the need for such replacements with operations and maintenance funding; however, accomplishment of any recommended replacement project requires, as a minimum, the approval of the Secretary of the Army. Recommendations may, if they embody significant modifications, be submitted by the Secretary to Congress for specific authorization. The River and Harbor Act of 1915 provides (Section 5) an authority to increase channel dimensions, beyond those specified in project authorization documents, at entrances, bends, sidings and turning places as necessary to allow the free movement of vessels. Exercise of this authority is confined to original project development; it has no general application to completed projects. (Modification of channel dimensions after project completion requires new authorization or a finding of design or construction deficiency.) Where not otherwise precluded by project authorization, the location of a completed channel may be altered during the course of the periodic maintenance program if the maintenance can thereby be more economically accomplished and related aids to navigation are readily adjustable to suit the restored channel dimensions at the shifted location.

10. Modification Under Existing Authority, Other Projects. Paragraphs 7,8 and 9 deal with the most common types of Corps projects. For other types, the possible basis for modification under existing authority may be drawn, inferentially, from their comparabilities (or incomparabilities) with the types covered.

11. Modifications Under Continuing Authorities of the Chief of Engineers. If a desirable project modification cannot be accomplished by using one of the various existing authorities discussed in preceding paragraphs, the modification may be suitable for consideration, authorization, and accomplishment under the continuing authorities program of the Chief of Engineers. This program consists of legislative authorities under which the Secretary of the Army, acting through the Chief of Engineers, is authorized to plan, design and construct certain types of water resources improvements without specific Congressional approval. Project modifications considered for authorization under this program will be targeted to meeting additional needs for flood control, navigation or beach erosion control rather than to adjustments of the completed project so as to better meet the needs the project was originally intended to serve. Modifications under this program are limited to complete-within-themselves, incrementally justified, improvements which will not impair or substantially change the project's capability to continue serving its original, Congressionally-authorized purposes. Nor may they be, in any way, substitutions for uncompleted Congressionally-authorized project modifications. Except for the legislatively imposed limitations on Federal costs (and the fact that a

Congressional authorization of modification would not be limited in its potential for changing originally authorized purposes or subsequent modifications) a modification authorized under the continuing authorities program is identical in force and relationship to the existing project as a modification specifically authorized by Congress as discussed in paragraph 11, below. Policies and procedures for implementing improvements under this program are provided in ER 1105-2-10 (Chapter 4).

12. Modifications Requiring Congressional Authorization. If a desirable modification cannot suitably be pursued under any of the authorities or programs discussed in the preceding paragraphs, implementation will require additional Congressional authorization. The necessary studies and report preparation required to obtain such authorization should be undertaken using existing Congressional study authorities which request a review of the specific project or basin, if available. If such specific study authorities are not available, Section 216 of the Flood Control Act of 1970 (Public Law 91-611) may be used. Section 216 states:

> "The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest."

Studies undertaken using the authority provided by Section 216 will be accomplished using the "Review of Completed Projects Program." Requests for guidance regarding funding, reporting and processing of reports to obtain additional authorization using this program should be addressed to CDR USACE (DAEN-CWP) WASH DC 20314.

FOR THE COMMANDER:

JAMES W. RAY
Colonel, Corps of Engineers
Chief of Staff

Illinois Historic Preservation Agency

Old State Capitol • Springfield • 62701

217/785-4512

ADAMS COUNTY
Alternatives to prevent sedimentation
of portions of Quincy Bay
Quincy

February 20, 1986

District Engineer
U.S. Army Engineer District, Rock Island
ATTN: Planning Division
Clock Tower Building - Post Office Box 2004
Rock Island, Illinois 61204-2004

Gentlemen:

Thank you for requesting comments from our office concerning the possible effects of your project on cultural resources. Our comments are required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic and Cultural Properties".

Our staff has reviewed the specifications of the above referenced project as submitted by your office. An examination of our records indicates that the proposed project will have no effect on historic and architectural resources.

One previously reported archaeological site, 11-A-45, is located just south of the Canton Chute Public Use Area in the northwest corner of the study area. Numerous archaeological sites are located along the bluff top just outside the eastern project boundary. A Phase I archaeological reconnaissance survey of all areas where there has not been any large scale disturbance of the ground surface (excluding agricultural activities) or major construction activity which would have destroyed existing cultural resources will be necessary.

If you have any further questions, please contact Mr. James R. Yingst, Staff Archaeologist, Illinois Historic Preservation Agency, Old State Capitol, Springfield, Illinois 62701, (217) 785-4997.

Sincerely,

William G. Farrar

William G. Farrar
Deputy State Historic
Preservation Officer

WFG:JRY:bv

Enclosure

cc: Julia Hertenstein

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ROCK ISLAND FIELD OFFICE (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

IN REPLY REFER TO:

COM: (309) 793-5800
FTS: 386-5800

April 24, 1986

Colonel William C. Burns Jr.
District Engineer
U.S. Army Engineer District
Rock Island
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

Dear Colonel Burns:

This is our planning aid report for the reconnaissance study of the sedimentation problem in Quincy Bay, Quincy, Illinois. It has been prepared in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.); the National Environmental Policy Act of 1969, as amended; the Endangered Species Act of 1973, as amended; and in accordance with the Fish and Wildlife Service's Mitigation Policy. This report has been coordinated with Illinois Department of Conservation (IDOC) at the field level. By copy of this report, we request IDOC's formal review and comment.

The purpose of this report is to evaluate potential impacts to fish and wildlife resources from project construction. Impacts related to decreasing sedimentation have only been briefly discussed since the Illinois State Water Survey sedimentation study has not yet been completed.

The elements of project construction to be evaluated in this early stage report include:

1. Maintenance dredging of Quincy Bay from the downstream end of Quinsippi Island to the mouth of Willow Slough.

2. Containment areas for Quincy Bay dredged material.

3. Construction of a dike extending from the upstream end of the access channel to the western corner of Triangle Lake.

4. Construction of an additional boat harbor north and adjacent to the existing harbor.

5. Closure or constriction of the access channel created in 1969.

Background

Quincy Bay is one of the largest natural bay complexes on the Upper Mississippi River and has a long history of economic and recreational importance. The main island (or Bay Island as it was previously called) was in existence as an island before installation of Lock and Dam 21. From a pre-impoundment photograph in 1938 (Figure 1), it is apparent that the island was commercially important. The island, and the Illinois bank were connected by a rail loop. Associated with the railroad was a barge terminal located approximately where the boat harbor now exists. Bottomland shrub communities interspersed with typical wetland vegetation and mature trees were present on the island south of the railroad bridge. North of the bridge, the land mass was larger and about two-thirds of the area was forested with mature trees, while about one-third appeared to be cleared for crop production.

After completion of Lock and Dam 21, the Quinsippi Island area consisted of about 50% flooded backwaters and 50% bottomland hardwoods/shrubs with some herbaceous wetlands. The flooded areas were primarily lowlands adjacent to existing sloughs and croplands. In a 1957 photograph (Figure 2), a channel was cut along the railroad embankment providing access from Broad Lake to the main channel.

In 1958-1959 a new railroad embankment was built and the downtown end of the loop was abandoned. Material for fill was dredged from the adjacent Broad Lake area. This resulted in near doubling in size of Broad Lake. In addition, a 3/4 mile long dike was built along the island upstream of and perpendicular to the railroad embankment to protect it from river erosion. With the construction of the dike, however, the access to the main channel from Quincy Bay was cut off.

Aerial photography from 1965 (Figure 3) shows the completed railroad embankment and dike. Broad Lake is noticeably larger than in 1957. Dredged material also appears for the first time along the channel side of the island, downstream of the railroad embankment.

By 1975 (Figure 4), recreational development had replaced the railroad/barge use of the 1930's. A new boat harbor in Squaw Chute was constructed in 1966. A city park was also developed on the upstream end of the island with the old railroad embankment serving as automobile access. In 1969, a new access channel between Quincy Bay and the main channel was dredged open by the Rock Island District.

Land use changes from 1957 to 1975 were determined by the GREAT II Side Channel Work Group. Upstream of the railroad embankment, about 19.9 acres changed from herbaceous and bottomland hardwood wetlands to open water due to dredging for railroad fill. Conversely, about 22.7 acres of open water were converted to bottomland hardwoods and developed areas along the railroad embankment. Downstream of the railroad embankment, about 4.5 acres which were open water in 1957 were changed to dredged material piles and bottomlands. With the creation of a historic park area, 13.1 acres of bottomland hardwoods and wetlands were converted to a recreational development. About 4.7 acres of formerly open water converted to herbaceous and woody wetlands by 1975. In total, about 24.9 acres of open water were converted to terrestrial lands or wetlands from 1957 to 1975.

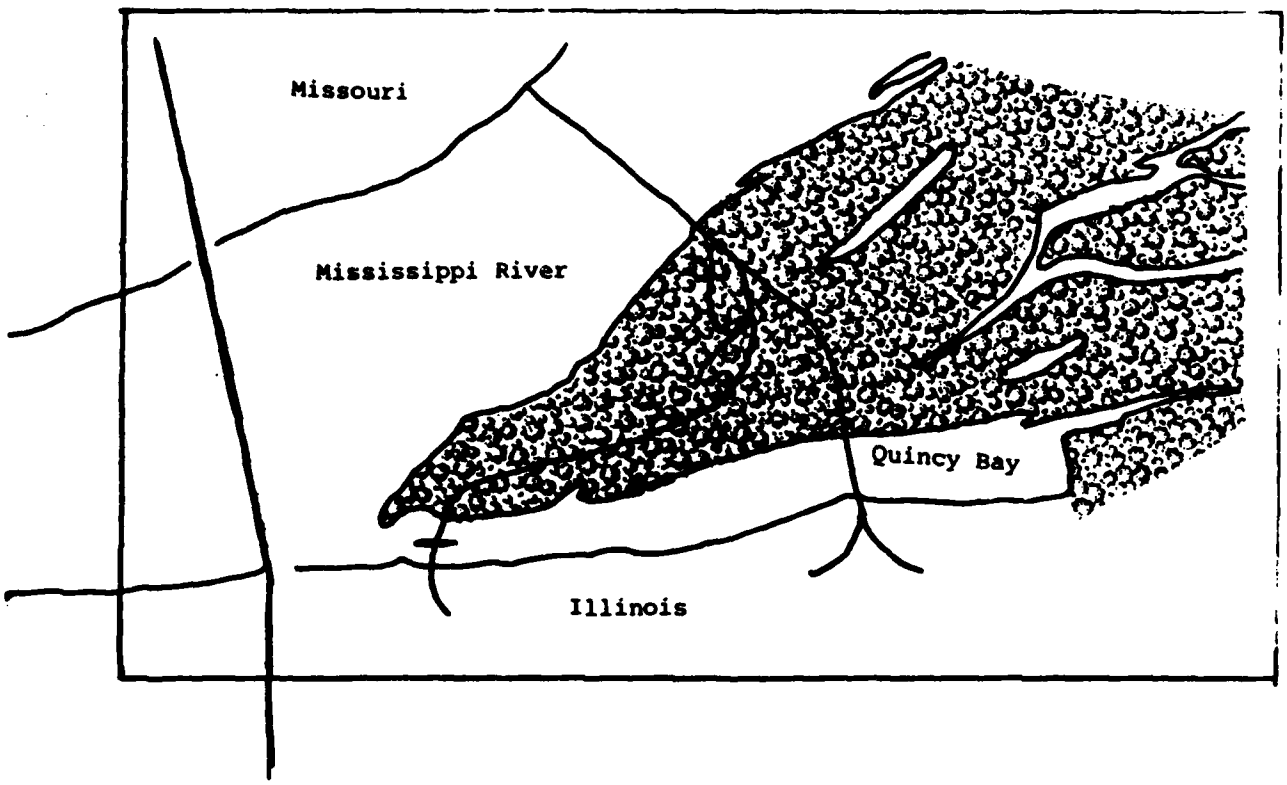


Figure 1. Quincy Bay area, 1938, before construction of Lock and Dam 21. Note the virtual absence of Broad Lake.

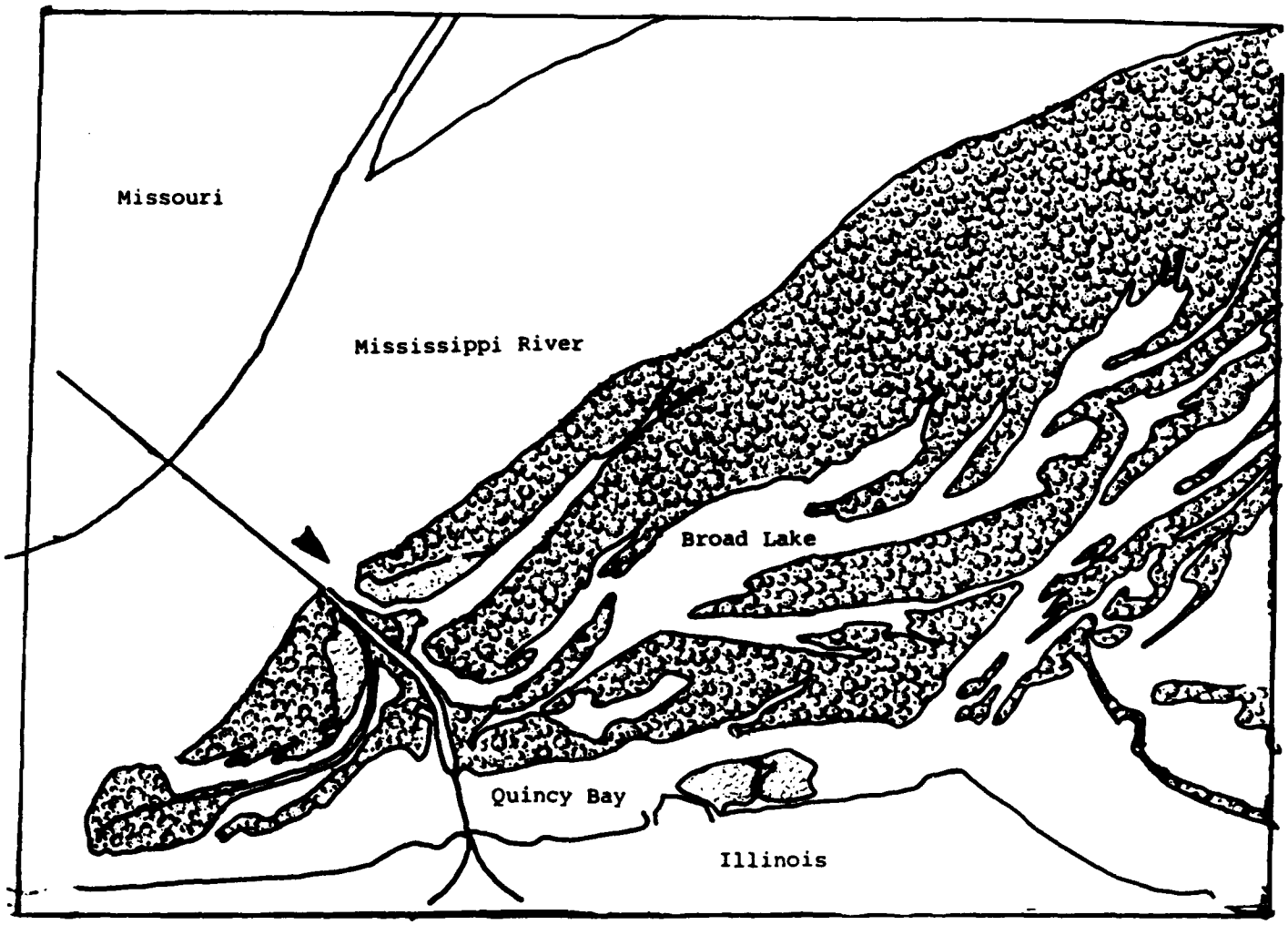


Figure 2. Quincy Bay area, 1957. Note access channel.

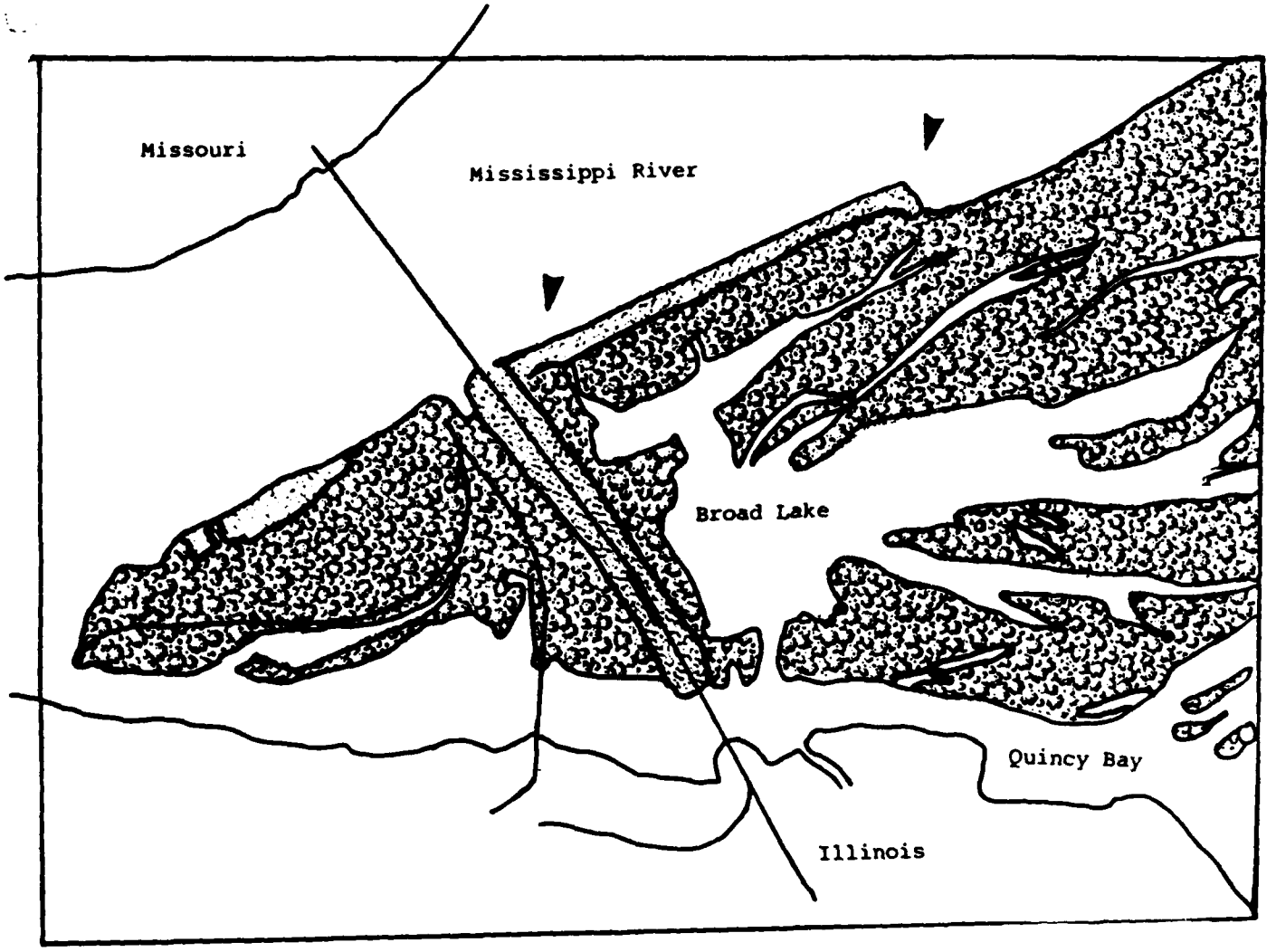


Figure 3. Quincy Bay area, 1965. Note closure of accesses and large size of Broad Lake.

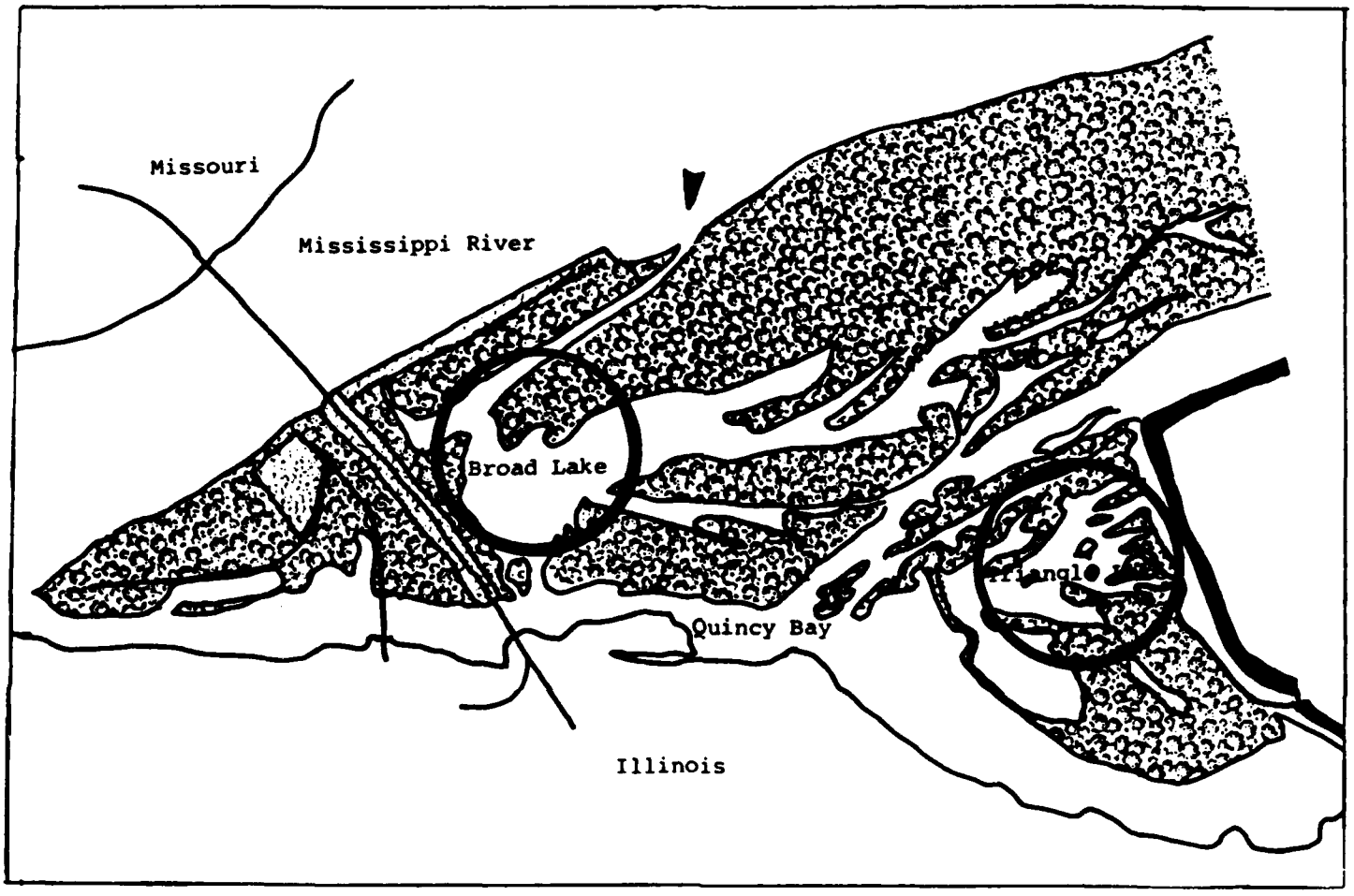


Figure 4. Quincy Bay area, 1975. Note the 1969 access channel and reduction in area of Broad Lake from 1965. Circles compare Broad Lake & Triangle Lake between 1975 & 1984 (Figure 5).

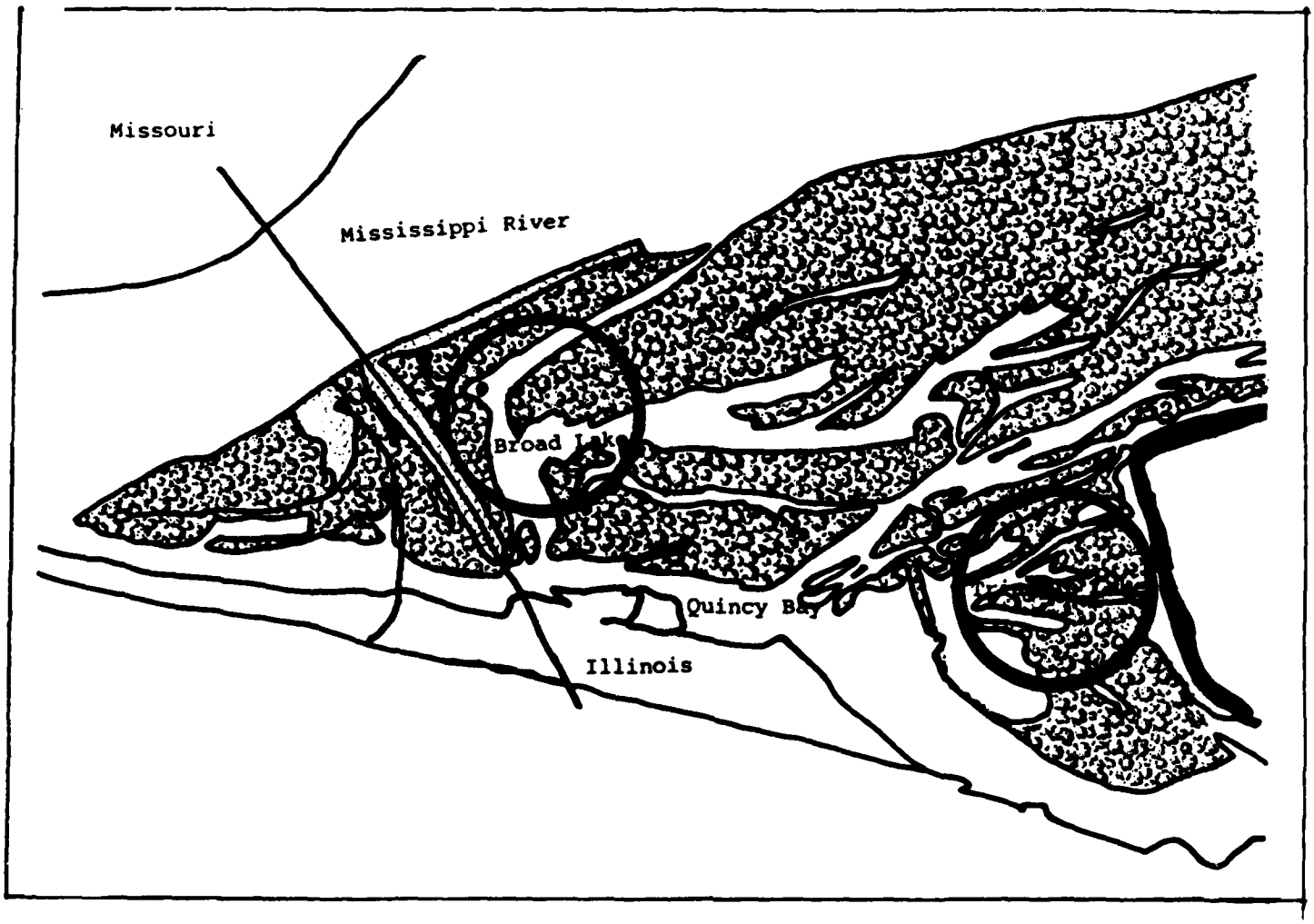


Figure 5. Quincy Lake area, 1984. Note increase in land within the circles drawn over Broad Lake and Triangle Lake as compared to 1975 (Figure 4).

Land use of the Quincy Bay area has essentially remained the same since 1975. However, in comparing Broad Lake in 1975 (Figure 4) to Broad Lake in 1984 (Figure 5), it is evident that considerable filling has taken place in the last years.

Fish and Wildlife Resources of the Project Area

A. Wildlife

The Quincy Bay complex is a significant resource for fish, wildlife and recreation. The complex, including Quinsippi Island, Broad lake, Triangle Lake and Quincy Bay, totals over 1100 acres. Primarily, the lands are mature, mixed bottomland forest composed of cottonwood, ash, willow and sycamore. Wildlife inhabiting these lands include white-tailed deer, raccoon, squirrel, beaver, muskrat, opossum, mink, skunk, fox and coyote.

Anderson and Woolf (1984) characterized the Quincy Bay area as critical habitat for the Illinois threatened river otter. The following are characteristics of habitats utilized by river otters, as determined by Anderson and Woolf, including the Quincy Bay area: (1) isolation from the main channel; (2) riparian habitats of extensive woodlands; (3) good water quality; (4) areas of open water in winter; and (5) presence of suitable den sites.

A river otter was picked up in a commercial fishing net from Quincy Bay backwaters in the summer of 1985. In addition, the Missouri Department of Conservation is stocking river otters across the channel from Quincy Bay. It is likely that the otters migrate back and forth across the river since studies have shown the feeding ranges extend for tens of miles.

The Quincy Bay complex is important nesting and highly valuable feeding habitat for the great blue heron. One rookery is located near Canton Chute public use area and several are located on Long Island, about five miles upstream. The Quincy Bay complex offers alternative rookery sites for herons moving from one colony to another or for colonies breaking into smaller groups. Great blue herons tend to locate/relocate in areas of close proximity to other rookeries which meet the basic criteria of relatively isolated acreage of mature trees with an open canopy near water (Short and Cooper, 1985). The bottomland hardwoods of the Quincy Bay complex meet these general criteria.

While only one of five rookeries within a ten mile radius is located in the Quincy Bay complex, it is likely that many of the great blue herons from these rookeries use the bay for feeding. Great blue herons prefer foraging in shallow (up to 1 1/2 feet deep), clear water with a firm substrate and a huntable population of small fish (less than 10 inches) (Short and Cooper, 1985). The area also needs to be free from human disturbance several hours a day while the herons are feeding. The Quincy Bay complex generally conforms to these critera, particularly in relation to the large degree of land to water interfaces, and the associated high productivity.

Waterfowl use the Quincy Bay both for breeding purposes and as resting and feeding habitat during migration. Mallards and wood ducks are the species

primarily breeding in the area. Spring and fall migrants include scaup, teal, ring-necked ducks, and mergansers. A 1985 recreational use survey conducted for the Illinois Department of Conservation by Huff and Huff, Inc. (1986) estimated 4,700 duck hunter user days in Quincy Bay.

Illinois Department of Conservation (IDOC) personnel are concerned that duck hunting will be greatly reduced in the Quincy Bay complex due to sedimentation of the backwaters. During the past two years, duck hunting has been very successful, due to high fall water levels. During an average or low water year, duck hunting is extremely poor due to lack of wetland slough habitat. As backwaters become too shallow for boat access, duck hunting blinds are forced into less and less area. Of 116 blinds located in Pool 21 and managed by IDOC, 79 of the blinds are located in Quincy Bay area. Ten years ago, over 110 blinds were located in the Quincy Bay area. Drawings for blind use occur every two years. This year's drawing will be for 65 blinds in Quincy Bay due to loss of backwaters through sedimentation. In two more years, IDOC is expected to remove 15 more, cutting the number down to 50. Desire to duck hunt has not diminished, however, as 1,500-1,800 hunters are expected to compete this year in the drawing for the Pool 21 IDOC blinds.

Regarding the furbearer resource, about 35-40 trappers work the Quincy Bay area. Primary targets are beaver, muskrat and racoon. Muskrats trapped in the bay are said to bring a better price than those of the drainage ditches due to greater size and quality of fur. Beaver and muskrat numbers are also decreasing due to reduced aquatic habitat.

Bird surveys were conducted in the Quincy Bay area with regards to construction of the Quincy Bridge. The surveys were conducted from June 6 to 17, 1980 by George Schneider and Alfred Pogge of Quincy College. Of 23 sites surveyed, six were within the Quincy Bay project area, including Canton Chute and Quinsippi Island. Most of the other sites surveyed were habitats similar to the Quincy Bay area. A combined total of 803 birds were observed of 52 different species in the Quincy Bay areas (Table 1). The veery (Hylocichla fuscescens), listed as threatened species in Illinois, was sited in floodplain forest across the channel near Cottonwood Island. The observers also noted other species known to occur in the area and stated, "During other bridge location impact studies earlier in the spring of 1980, we observed the golden eagle, bald eagle, osprey, peregrine falcon, marsh hawk, and cooper's hawk in the study areas" (Schneider and Pogge 1980).

B. Fish

The aquatic habitat of Quincy Bay may be primarily characterized as backwater lakes and sloughs, in that they are protected from the main channel, have almost no current velocity, and have a silty bottom. Of the approximate 1100 acres in the project area, about one-half or 550 acres, are aquatic. Quincy Bay (upstream of the railroad bridge) contains about 192 acres, Broad Lake 138 acres and Triangle Lake 68 acres. The side channel habitat covers about 130 acres, not including the channel through Broad Lake proper. The high percentage of land/water interface aids the diversity and productivity of the backwater complex. Fallen trees and log snags along the shoreline provide excellent fish cover and feeding areas. In areas where the waters are protected from turbidity, aquatic vegetation flourishes, providing spawning and feeding habitat for many species of fish.

TABLE 1. Numbers of each species of birds observed in each corridor, June 9-17, 1980, near Quincy, Illinois.

	Corridor						
	1&2	3A&B	3C	4	5	6	Total
Great blue heron, *Ardea herodias*					6	3	9
Green heron, *Butorides virescens*					1	7	8
Black-crowned night heron, *Nycticorax nycticorax*						1	1
Mallard, *Anas platyrhynchos*						4	4
Wood duck, *Aix sponsa*	1		10	1	1	2	15
Turkey vulture, *Cathartes aura*			1			3	4
Red-tailed hawk, *Buteo jamaicensis*					1		1
Sparrow hawk, *Falco sparverius*			3				3
Bobwhite, *Colinus virginianus*	2		4			1	7
Killdeer, *Charadrius vociferus*	2						2
Mourning dove, *Zenaidura macroura*	21	5	17	4	3	10	60
Yellow-billed cuckoo, *Coccyzus americanus*	10	8	4	2	11	4	39
Ruby-throated hummingbird, *Archilochus colubris*			3		1	1	5
Common flicker, *Colaptes auratus*	6	4		1	9	10	30
Pileated woodpecker, *Dryocopus pileatus*	2	2		2	3	2	11
Red-bellied woodpecker, *Centurus carolinus*	3	2	3	1		2	11
Red-headed woodpecker, *Melanerpes erythrocephalus*	31	8	10	5	22	30	106

TABLE 1 Continued

	Corridor						
	1&2	3A&B	3C	4	5	6	Total
Hairy woodpecker, Dendrocopus villosus	1			1		2	4
Downy woodpecker, Dendrocopus pubescens	10	6	7	5	5	3	36
Eastern kingbird, Tryannus tyrannus		1			1	1	3
Great crested flycatcher, Myiarchus crinitus	23	1	1	3	16	6	50
Eastern phoebe, Sayornis phoebe	5	5	1		4	3	18
Acadian flycatcher, Empidonax virescens	1						1
Least flycatcher, Empidonax minimus	4		1		5		10
Eastern wood pewee, Contopus virens	7	9	1	2	2	1	22
Horned lark, Eremophila alpestris						4	4
Tree swallow, Iridoprocne bicolor	8	21	13	4		5	51
Bank swallow, Riparia riparia		5					5
Cliff swallow, Petrochelidon pyrrhonota		1					1
Barn swallow, Hirundo erythogaster	1						1
Blue jay, Cyanocitta cristata	23	21	18	4	10	9	85
Common crow, Corvus brachyrhynchos	2	8	4		4	5	23
Black-capped chickadee, Parus atricapillus	28	16	15	2	15	1	77
Tufted titmouse, Parus bicolor	11	3	5	1	5	5	30
White-breasted nuthatch, Sitta carolinensis	13	9	2			6	30

TABLE 1 Continued

	Corridor						
	1&2	3A&B	3C	4	5	6	Total
House wren, Troglodytes aedon	6	8	2			1	17
Carolina wren, Thryothorus ludovicianus	1				2	3	6
Short-billed marsh wren, Cistothorus platensis					1		1
Mockingbird, Mimus polyglottos		1				1	2
Catbird, Dumetella carolinensis	7	6	9		1		23
Brown thrasher, Toxostoma rufum	4	3	6		7	5	25
Robin, Turdus migratorius	25	39	49	11	12	6	142
Wood thrush, Hylocichla mustelina	2		1	2		1	6
Veery, Hylocichla fuscescens	1					1	2
Blue-gray gnatchatcher, Polioptila caerulea	1				1		2
Starling, Sturnus vulgaris	11	73	18		7	4	113
Yellow-throated vireo, Vireo flavifrons	1		1				2
Red-eyed vireo, Vireo olivaceus	6	5					11
Black-and-white warbler, Mniotilta varia		1					1
Prothonotary warbler, Protonotaria citrea	3		2		3	2	10
Yellow warbler, Dendroica petechia				1	4		5
Louisiana waterthrush, Seiurus motacilla	4						4
Yellow throat, Geothlypis trichas	5		2		6		13

TABLE 1 Continued

	Corridor						
	1&2	3A&B	3C	4	5	6	Total
Yellow-breasted chat, Icteria virens					2		2
Yellow-throated warbler, Dendroica dominica		1					1
American redstart, Setophaga ruticilla	2						2
House sparrow, Passer domesticus	20	14	22	2	11	7	76
Eastern meadowlark, Sturnella magna	1		3		1		5
Red-winged blackbird, Aglaius phoeniceus	66	17	19	24	16	28	170
Northern oriole, Icterus galbula	27	8	19	3	19	11	87
Common grackle, Quiscalus quiscula	74	35	64	30	49	54	306
Brown-headed cowbird, Molothrus alter	15	9	13	8	19	10	74
Scarlet tanager, Piranga olivacea	2						2
Cardinal, Richmondena cardinalis	29	28	17	1	26	16	117
Rose-breasted grosbeak, Pheucticus ludovicianus	5	7	3			2	17
Indigo bunting, Passerina cyanea	21	10	20	6	37	20	114
Dickcissel, Spiza americana	2		1		1		4
American goldfinch, Spinus tristis	4	5	3	1	23	2	38
Rufous-sided towhee, Pipilo erythrophthalmus	1	1					2
Vesper sparrow, Pooecetes gramineus	1						1
Lark sparrow, Chondestes grammacus					1		1

TABLE 1 Continued

	Corridor						
	1&2	3A&B	3C	4	5	6	Total
Chipping sparrow, *Spizella passerina*	1						1
Field sparrow, *Spizella pusilla*					2	1	3
Song sparrow, *Melospiza melodia*					2		2
Total birds	562	406	397	127	378	306	2177
Acres sampled	108.7	56.3	79.4	36.4	84.1	75.4	
Birds/acre	5.17	7.21	5.0	3.49	4.5	4.06	
Total species	53	38	40	26	44	46	

From: Schneider and Pogge, 1980. Corridors 1 & 2, 3A & B, and 3C are within the Quincy Bay project area. However, species observed in the other corridors likely also occur there, particularly the herons.

Fish surveys using electrofishing have been conducted by the Illinois Department of Conservation (IDOC) since 1973 in Willow Slough between Broad Lake and Triangle Lake. The IDOC reports no significant change in the fishery over the past 10 years (Table 2). Their 1974 sample contained channel catfish up to 6 pounds, bluegill to 0.4 pound, largemouth bass to 2 pounds, and crappie up to 1.25 pounds. Ten years later, in 1984, the IDOC collected channel catfish up to 2.5 pounds, bluegill to 0.4 pound, crappie up to 1.1 pounds and largemouth bass up to 2.5 pounds. Fish collected in 1985 were slightly more abundant and slightly smaller than those collected in 1984. The species composition, representative of lake habitat, has remained consistent throughout all years sampled.

The upper end of the 1969 dredged access channel has fairly strong current velocities and may be considered as side channel habitat (Rasmussen 1979). This area was electrofished by the IDOC in September 1985 (Table 3). The species composition was basically similar to the Willow Slough samples with the addition of river shiner, sportfin shiner, bullhead minnow, green sunfish and white bass. Number of fish captured was low except for the emerald shiner. The dredged cut area was over 20 feet deep and the banks were eroding severely.

ENDANGERED SPECIES

To facilitate compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal Agencies are required to obtain from the Fish and Wildlife Service information concerning any species, listed or proposed to be listed, which may be present in the area of a proposed action. Therefore, we are furnishing you the following list of species which may be present in the concerned area:

Classification	Common Name	Scientific Name	Habitat
Endangered	Bald Eagle	Halaiaeetus leucocephalus	Breeding Wintering
Endangered	Indiana Bat	Myotis sodalis	Caves and Riparian Habitat

In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended, the Federal agency responsible for actions authorized, funded, or carried out in furtherance of a construction project that significantly affects the quality of the human environment, is required to conduct a biological assessment. The purpose of the assessment is to identify listed or proposed species likely to be adversely affected by their action and to assist the Federal agency in making a decision as to whether they should initiate consultation.

Section 7(d) of the 1978 Amendment to the Endangered Species Act underscores the requirement that the Federal Agency and the permit or license applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which in effect would deny the formulation or implementation of reasonable alternatives regarding their actions on any Endangered or Threatened species.

Table 2. Willow Slough CPE (no./hr.) Electrofishing. From: Illinois Dept. of Conservation

	10/1/73	8/14/73	1974	1976	1977	1978	1979	1980	1981	1982	1983	1984	7/29/85	9/17/85
Paddlefish						1								
Longnose gar			.7				4			1				2
Shortnose gar	1		.7	9	2	3	3	.7	3		3	1	2	
Bowfin	3	3	1.3		2				2		1	1		2
American eel	1													
Gizzard shad	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Carp	92	40	90.4	49	52	30	45	74.4	43	118	50	28	124	94
Emerald shiner	5								7				18	80
River carpsucker	13		5.4	3	9	15	8	2.7	9		3		8	4
Quillback			.7					.7				1		
Highfin carpsucker										8				
Smallmouth buffalo	6	5	8.7	6	2	17	12	9.4	19	18	20	10	10	30
Bigmouth buffalo		2	4.7	22	14	7	2	6.0	11	5	4			36
Black buffalo			.7		1					6				
Channel catfish	15	6	4.7	1	3			3.4	3	2	3	1	4	2
Flathead catfish				2			1	1.3		3	2		6	10
Blackstripe topminnow								.7						
White bass	5	5	.7	1	2	1	2		5	1				
Warmouth					1	3	1		1			1	2	14
Orangespotted sunfish	2	1	1.3										8	
Bluegill	12	15	22.1	20	48	28	7	38.9	18	44	13	29	54	258
Hybrid sunfish			.7		1					1				
Largemouth bass	3	1	3.4	10	3	11	6	6.0	1	12	9	6		14
White crappie	35	9	12.1	15	33	9	21	26.8	24	17	42	22	30	24
Black crappie	14	5	3.4	3	5	2	7	4.7	4	4	8	6	8	2
Sauger						2	1			2				
Walleye						1								
Freshwater drum	18	1	5.4	12	13	13	3	8.7	8	17	9		36	12
Total	230	117	167.1	153	197	143	123	184.4	158	259	167	106	310	584

Table 3. Dredge cut to Quincy Bay, September 17, 1985. From: Illinois Dept. of Conservation.

Species	Number
Gizzard shad	6
Carp	9
Emerald Shiner	29
River shiner	1
Spotfin shiner	2
Bullhead minnow	2
Channel catfish	1
Flathead catfish	2
White bass	3
Green sunfish	3
Orangespotted sunfish	1
Bluegill	7
Largemouth	2
White crappie	1
Freshwater drum	2
TOTAL	71

There is no designated critical habitat in the project area at this time.

The bald eagle over-winters along the Upper Mississippi River corridor, feeding on fish in areas of open water and perching in nearby large trees. The bald eagle has been documented as perching in trees along Quincy Bay (Figure 6). No sitings of the Indiana bat have been documented in the project area. However, if the proposed project involves any tree removal, both species should be considered in the biological assessment. For any proposed wintertime construction, impacts to the bald eagle should be considered.

IMPACTS TO FISH AND WILDLIFE RESOURCES FROM PROPOSED PROJECT ALTERNATIVES

1. No Project - Sedimentation of Backwaters

Sedimentation of the backwaters is one of the major problems on the Upper Mississippi River. Sedimentation accelerates ecological succession of aquatic habitats resulting in loss of water surface area to less productive woody habitats. Comparison of aerial photography from 1956 and 1975 by the GREAT II Side Channel Work Group (SCWG) showed a conversion of approximately 9,000 acres of open water to vegetated habitat due to sedimentation.

Besides the direct loss of habitat by filling, sedimentation adversely affects the resource as described below.

a. Turbidity. Fine silty sediments which remain in suspension until reaching the quiet backwaters are easily resuspended by the slightest agitation. The resulting turbid conditions reduces light necessary for photosynthesis and the sustenance of plants; reduces visibility for sight feeders including fish, avian and mammalian predators; and suffocates filter feeders like mussels and other benthic invertebrates.

b. BOD. Siltation traps organic matter on the bottom, and in the decomposition process creates an oxygen demand competing with that of the fauna. This condition is particularly acute during low water periods and during winter ice cover.

c. Soft substrate. Silty soft substrates are unsuitable spawning grounds for important sport fish like largemouth bass. Eggs laid in silt or which become covered with silt are likely to smother and are more susceptible to disease.

The GREAT II SCWG estimated backwater losses due to four alternative scenarios as follows.

Estimate A - Given the sedimentation rate of 1-2 inches per year estimated by GREAT I, we calculate a 50-year accumulation of 4-8 feet of sediment in most backwater areas. It is the experience of the work group that most backwater areas are less than 8 feet deep. Thus, their fate is obvious and a near total loss would be anticipated.

Estimate B - Given the measured loss of 8 percent of backwater surface area in 20 years (0.43 percent per year), we calculate an additional loss of 20

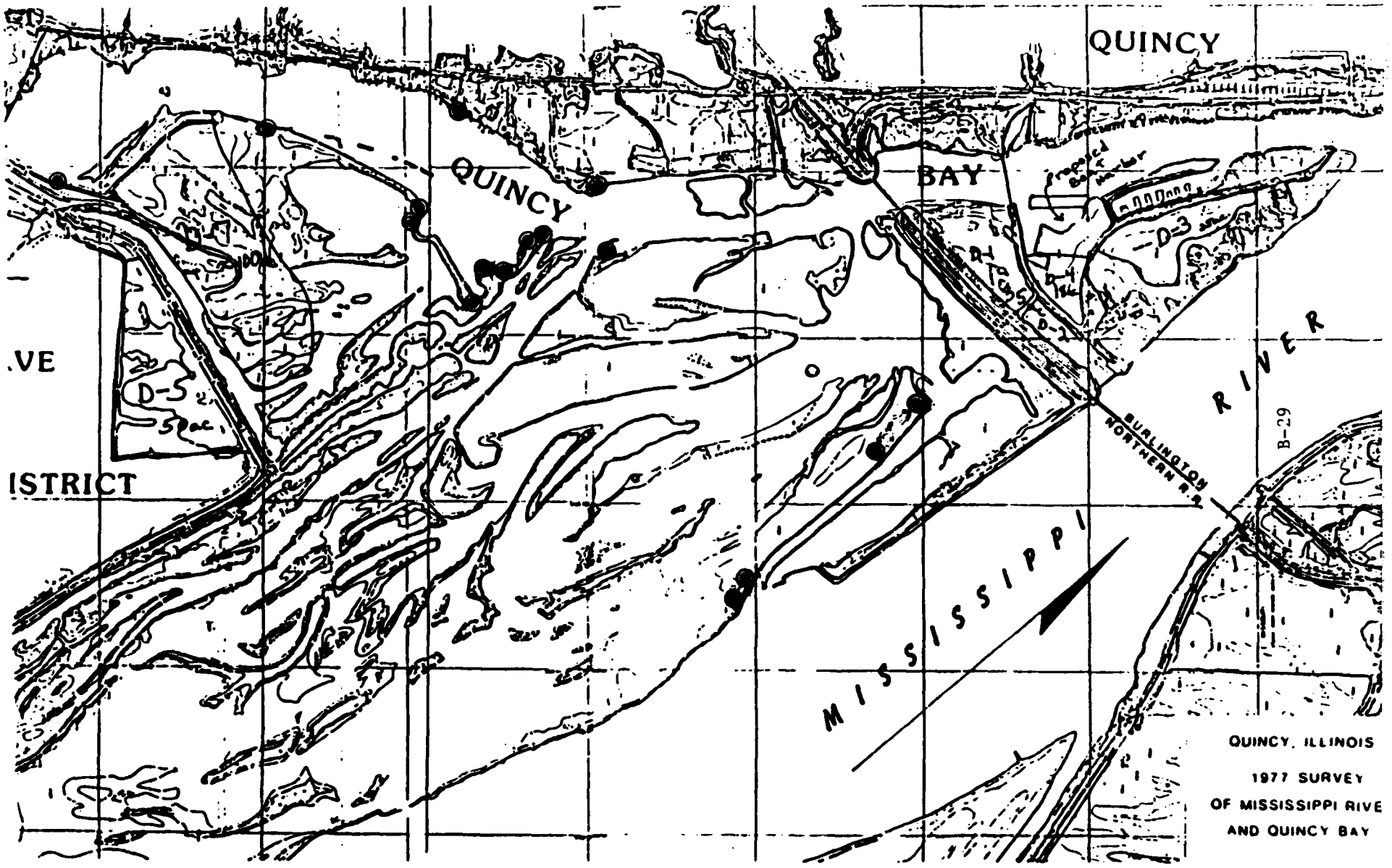


FIGURE 6. Eagle perching areas (black dots). Compilation from Ostdiek, Pogge and Schneider, 1980, and Schneider and Pogge, 1981.

percent of the original surface area in 50 years or 22 percent of the existing water surface area (12,600 acres).

Estimate C - Given the prediction that only main side channels and chutes will remain intact once the river has reduced its cross-section compatible with its flow characteristics (Simons et al., 1975a), we calculate the loss of 34 percent (19,000 acres) of the existing water surface area. These figures were estimated from the Habitat Inventory Maps, considering present trends and patterns of sedimentation in backwater areas and the likeli hood that individual side channels will remain open and flowing. (This estimate is essentially the same as "A").

Estimate D - Given the GREAT I estimated loss of 25 percent of backwater surface area in 34 years (0.74 percent per year), we calculate an additional loss of 37 percent of the original acreage or 49 percent of the existing acreage (28,000 acres).

Estimates B, C, and D are summarized by pool in Table 4. The estimates paint an appropriately grim picture of the fate of Upper Mississippi River backwaters under current conditions.

2. Maintenance dredging of Quincy Bay from the downstream end of Quinsippi Island to the mouth of Willow Slough.

Dredging the Quincy Bay area will enhance the aquatic resource by improving:

a. Water quality. Removal of silty sediments would reduce the BOD and would increase the water volume to substrate ratio for the remaining silty areas. The increased water volume and reduction of silt would also reduce turbidity, allowing for better sight feeding and plant respiration.

b. Fish habitat quality. Dredging would deepen the bay area and thus reduce winter fish kill and may provide habitat diversity. During the electrofishing of Willow Slough, large concentrations of fish were found in deep holes in the slough channel where, presumably, dredged material had been excavated. Similarily, holes dredged in Bussey Lake near Guttenberg, Iowa greatly enhanced the winter ice fishery (Ackerman, pers. comm., 1985). Thus, dredging performed in Quincy Bay, conducted in a manner such that deep holes are scattered throughout the dredged area, should improve the fishery. Bertrand (1980) cites the following criteria for fish habitat improvement:

> "Largemouth bass, sunfish, crappie and bullhead prefer narrow shallow backwaters with little flow - areas being lost most rapidly due to sedimentation and efforts to keep flow diverted to the navigations channel. Habitat preservation or enhancement is most needed in these areas. Efforts to improve these areas by dredging to deepen them - off-setting sedimentation and providing depths for winter survival - should be planned to allow adjacent areas of the preferred shallower waters. Outside of some deeper water (10 foot +) areas needed for winter survival, the ideal habitat for these species apparently would include shallow (maximum depth four to six feet) water not subject to rapid loss from sedimentation."

Table 4. Estimated losses of backwater habitat due to sedimentation and vegetation over the next 50 years.

Pool	Existing Backwater Acreage*	Future Losses Estimate "B" Acres	%	Future Losses Estimate "C" Acres	%	Future Losses Estimate "D" Acres	%
11	9920	2182	22	2689	27	4861	49
12	5473	1204	22	2507	46	2682	49
13	11993	2638	22	4817	40	5877	49
14	3277	721	22	1763	54	1606	49
15	922	203	22	0	0	452	49
16	4894	1077	22	1266	26	2398	49
17	3942	867	22	1266	32	1932	49
18	4396	967	22	1480	34	2154	49
19	6348	1397	22	1295	20	3111	49
20	1655	364	22	536	32	811	49
21	2878	633	22	1250	43	1410	49
22	1620	356	22	605	36	794	49
Total	57373	12622	22	19474	34	28113	49

* Acreage calculated from the Habitat Inventory maps by Hagen, Werth, and Meyer (1977). From GREAT II Side Channel Work Group Report.

c. Wildlife habitat quality. Permanent water is mandatory for the life history requirements of such wildlife species as river otter, beaver and muskrat. Wetlands that provide permanent year-round surface water are assumed to provide potentially optimum habitat for muskrats while wetlands with water present on a seasonal basis are assumed to have little, if any, potential for meeting the year-round cover requirements of the species (Allen and Hoffman 1984). Likewise, a permanent and relatively stable source of water is mandatory for suitable beaver habitat (Allen 1982).

River otters require not only permanent water, but also water with good clarity (Anderson and Woolf 1984). Turbidity would be reduced in areas dredged since sediments would be less affected by surface action due to greater depth. Turbidity reduction would improve sight feeding for furbearers (i.e. river otter) and the wading birds. For waterfowl habitat improvement, small sloughs in addition to Quincy Bay should also be dredged. The sloughs should be dredged 10 feet deep in the center (for duck blind access) and gently sloping along the shorelines for dabling duck feeding habitat.

d. Succession. Dredging would set back succession of the wetland habitats, from woody growth (which is less productive and diverse) back to open water/herbaceous.

Adverse effects could result if the silty sediments are contaminated. During the dredging operation, the contaminated sediments could become resuspended in the water column. This would allow the contaminated material to reenter the food chain, and concentrate in predators like sport fish and bald eagles. Therefore, sediments to be dredged must be analyzed, using both quantitative and elutriate tests.

3. Containment areas for dredged material.

Containment areas are required for dredging the upper portion and the lower portion of Quincy Bay. Four areas on Quinsippi Island have been proposed by Rock Island District staff for disposal of material dredged from the upper portion (Figure 7). All four areas on Quinsippi Island are wetlands. Areas D-1 and D-2 total about 35 acres. Both areas are bottomland hardwoods which totally flood in spring. Flooded bottomlands have been shown to provide important spawning habitat for many game species like northern pike. About 10 acres are palustrine herbaceous, non-persistent wetlands. These areas in combination with the adjacent woodlands, provide excellent wood duck nesting and brood habitat. Filling D-1 snd D-2 would result in the loss of all wetland values of the habitat. If the standing timber survived, canopy and terrestrial values would remain. Timber species composition could be improved by planting mast-producers which are more beneficial to wildlife; however, it may require many years of growth before benefits to wildlife are realized.

Area D-3 also contains about 35 acres of bottomland hardwoods which flood in the spring. Since this area is isolated by sand spoil areas and a raised access road to the boat harbor, it is less accessable to spawning fish or furbearers. Filling D-3 would eliminate the wetland values, though the area

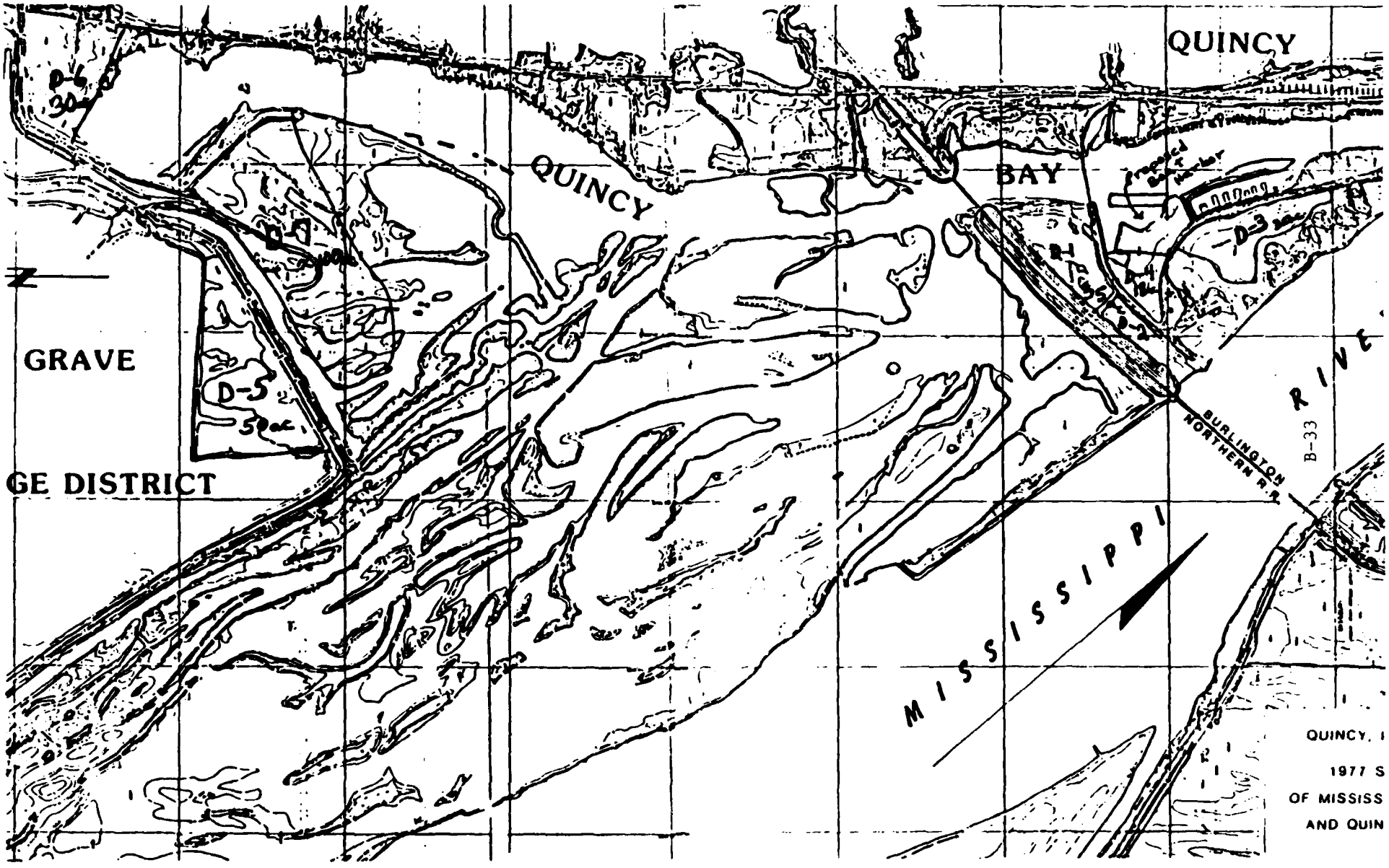


FIGURE 7. Proposed dredged material containment areas.

is likely not as valuable to fish and wildlife as an area adjacent to the river. If the trees were killed, canopy losses would be significant.

Area D-4 is bottomland hardwoods with about 10 acres of backwater slough habitat including emergent and submergent aquatic plants and areas of open water. About 2 acres of the slough is proposed to be filled as D-4, with the remaining slough acreage proposed as a boat harbor (see item 4, page 25). D-4 is very valuable for its access to Quincy Bay and its natural wetland features. The area is, however, surrounded by an access road which may limit its value to wildlife. Impacts to the area may be reduced by avoiding fill into the slough area and by leaving a buffer of trees around the containment area.

Areas which also may be suitable for dredged material placement but were not recommended by your staff are the sand spoil areas and the undeveloped park-like areas. Over 35 acres of these non-wetlands are present on Quinsippi Island. The park-like lands coupled with D-3 should provide adequate containment space, leaving the more valuable fish and wildlife areas of D-1, D-2, and D-4 untouched.

Containment areas proposed for the upper portion of Quincy Bay are about half marginal cropland and park-like land, and half wetlands. Fifty acres of marginal cropland/old field within the Indian Graves Drainage District (D-5, Figure 7) have been proposed as a containment area. The acreage is surrounded by croplands and levee. One section, about 7 acres, is a scrub/shrub wetland dominated by willows. No open water or non-persistent emergents are noticeably present. When the remainder of the field is too wet to farm, foxtail, ragweed, panic grass, smartweed and sedges are present. Thus, some habitat losses would occur from filling this site, but they would be less than a tract riverward of the levee.

Site D-6 is about 30 acres in size with half old field/cropland and half mature bottomland hardwoods. If silt were disposed here, care would need to be taken to prevent suffocating the trees through excessive silt coverage. Possibly a primary containment area could be made from the cleared land and an overflow or secondary containment area constructed around the mature bottomlands. Impacts to the proposed site would depend upon how the site was constructed.

Site D-7 is about 100 acres within the Triangle Lake area. The habitat is predominantly bottomland hardwoods interspersed with emergent and submergent aquatic vegetation occurring in the understory and in sloughs and ponds. Significant losses to fish and wildlife resources would result from the construction of a containment pond in these wetlands. Therefore, we do not recommend the use of this site.

3. Construction of a dike, extending from the upstream end of the access channel to the western corner of Triangle Lake.

Dike construction is proposed to relieve the high sedimentation rates due to periodic flooding of the Mississippi River. The effectiveness of such a dike needs to be analyzed. However, if the structure is successful in significantly reducing the rate of sedimentation, major benefits to fish and wildlife resources of the Quincy Bay area would result.

Adverse impacts from dike construction would include clearing many acres of bottomland hardwoods and filling sloughs. In addition, the dike would provide easy pedestrian access to areas generally limited to fishing boats. By traversing the backwater complex with a dike, wildlife travel lanes may be disrupted by the obstruction of the dike and by human intrusion particularly regarding the Illinois threatened river otter. However, these impacts must be weighed against the possibility of a major habitat loss due to continued sedimentation. At this early planning state, information is insufficient to properly weigh the benefits and losses. The project should be examined using the Service's Habitat Evaluation Procedures (HEP).

4. Construction of an additional boat harbor north and adjacent to the existing harbor.

Construction of the boat harbor would eliminate the shallow shoreline habitat riverward of the D-4 disposal site. The shoreline is predominantly thick arrowhead beds interspersed with other submergent and emergent aquatic plants. This area is excellent waterfowl and fish breeding and feeding. Dredging and filling would remove the aquatic vetetation, while heavy boat use would preclude much wildlife use. Mainland alternatives should be given thorough consideration before a site selection is made. Habitat Evaluation Procedures (HEP) should be used to analyze boat harbor alternatives and trade-offs.

5. Closure or construction of the access channel constructed in 1969.

Though we have not reviewed the results of the Illinois State Water Survey's sedimentation study, it is apparent that the 1969 cut is severely eroding the banks on both sides of the channel. It also appears likely that the bulk of the sediments drop out at Broad Lake where the width of the channel fans out into the 138 acre lake. At a minimum, the banks on both sides of the channel should be riprapped for the extent of the channel. If this would result in erosion of sediments in Broad Lake, an analysis should be conducted to determine where these sediments would go. Possibly a low level notched closing dike should be considered which is passable to recreational boats.

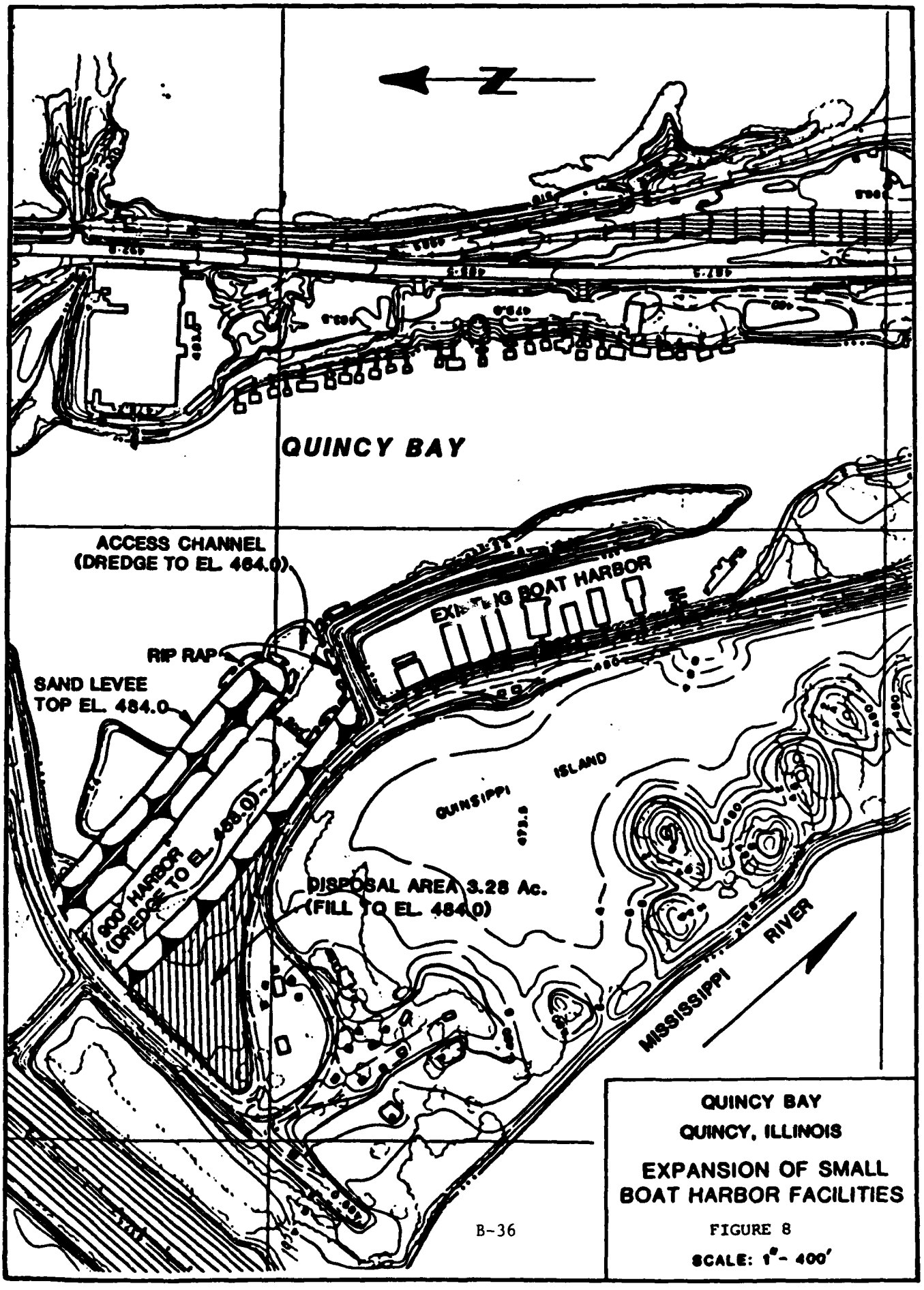
Recommendations for Future Study and Information Needs

In general, we fully support the efforts to reduce sedimentation and the dredging to relieve clogged backwaters. To properly assess fish and wildlife impacts at the feasibility study stage, the following information is needed.

1. Sediments to be dredged must be analyzed for contaminants by both quantitative and elutriate testing.

2. Project alternatives should be analyzed using the Habitat Evaluation Procedures, particularly the dike and boat harbor.

3. Depth of silt disposal in bottomland hardwoods areas should be determined to the points of 100%, 50%, and 0% survival of the trees. Wooded sites should then be considered for disposal with minimal harm to the trees.



QUINCY BAY
QUINCY, ILLINOIS

EXPANSION OF SMALL BOAT HARBOR FACILITIES

FIGURE 8

SCALE: 1" = 400'

During the feasibility planning stage, the following alternatives to enhance and protect fish and wildlife resources of Quincy Bay should be considered:

1. In coordination with IDOC wildlife biologists, selected sloughs should be dredged for waterfowl use and duck hunter access. The sloughs should be dredged to 10 feet deep in the center for duck blind access and gently sloping along the shorelines for dabbling duck habitat. These criteria will also benefit the sport fishery of the sloughs.

2. Deep holes, selected in coordination with the Illinois Department of Conservation, should be dredged in Quincy Bay to enhance fish habitat and recreational fishing.

3. Indian River Drainage Ditch should be channeled into a settling basin before entering Quincy Bay, to minimize sedimentation.

4. A low level notched closing dike passable to recreational boats should be constructed across the upstream end of the access channel to minimize erosion and transport of sediments into Broad Lake. In addition, the banks of the channel should be riprapped.

5. Mainland alternatives for boat harbor construction would be less damaging to fish and wildlife resources than the Quinsippi Island area, which contains about 20 acres of palustrine emergent non-persistent wetlands, and should be given thorough consideration in the next stage of planning.

6. Triangle Lake should not be used as a disposal site. Agricultural, old field or other disturbed areas should be given first consideration.

7. The park-like lands on Quinsippi Island coupled with containment area D-3 (Figure 7) should be given primary consideration for placement of dredged material, leaving the more valuable fish and wildlife areas of D-1, D-2, and D-4 unaffected.

We appreciate the opportunity to provide comments at this early stage of planning. If you have any questions, please do not hesitate to contact Jody Millar or myself.

Sincerely,

for Richard C. Nelson
Field Supervisor

cc: IDOC (Lutz, Sallee, Sanders, Zebron)
USEPA (Chicago)
ILEPA (Yurdin)
FWS (Stratton)

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Illinois Department of Conservation
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Michael B. Witte, Director • James C. Helfrich, Assistant Director

June 2, 1986

Mr. Richard C. Nelson
Field Supervisor
USDI, FWS
Rock Island Field Office(ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

Dear Mr. Nelson:

Department staff has reviewed your April 24, 1986 planning aid report for the Rock Island Corps' reconnaissance study of the sedimentation problem in Quincy Bay, Quincy, Illinois. We generally concur with the report and its recommendations.

Relative to your discussion of river otters on page 8, we wish to advise you that use of the Quincy Bay area by river otters has been documented. Department law enforcement personnel reported the sighting of 2 otters at Broad Lake on May 6, 1986. Two other sightings in the vicinity have also been reported during May. Because of this confirmed use of the area by otters, we support the USFWS recommendation (No. 2) that Habitat Evaluation Procedures (HEP) or similar methods be used to examine the pros and cons of the project before plans are approved. Dike construction is of particular concern in this regard.

In your discussion of bald eagles (page 18), you mention that eagles feed on fish on areas of open water and perch in nearby large trees. You also discuss the importance of assessing the impacts to the bald eagle from wintertime construction. We recommend that future reports should also discuss the effects of construction, clearing or dredge spoil disposal on roost sites for wintering bald eagles.

Thank you for the opportunity to comment on your planning aid report.

Sincerely,

Michael B. Witte
Director

RWL:bp

B-39

JUL 13 1986

cc: Rock Island Corps, Burns

Illinois Department of Conservation
life and land together

office memorandum

to: Jody Millar

from: Glenn Sanders

date: June 6, 1986

subject: Quincy Bay Project

Dear Jody,

Here is an updated map of the Quincy Bay Area, with some notations on possible dredge spoil deposit areas. Also it should be noted that the Triangle Lake is now a State Waterfowl Refuge.

For your information we now have additional confirmed sightings of river otters in the Bay, with one breeding pair noted. Also our wild turkey program seems to be taking hold with turkeys now found throughout the complex.

Please consider the possibility of using the dredge spoil to create mounds of dirt throughout the complex that would provide high water refuge for the wildlife that is now displaced by the high water.

If I can be of additional assistance please call.

Yours Truly,

Glenn Sanders

Glenn Sanders

Ill. Conservation Police

Illinois Department of Conservation
life and land together

office memorandum

to: Page Two

from:

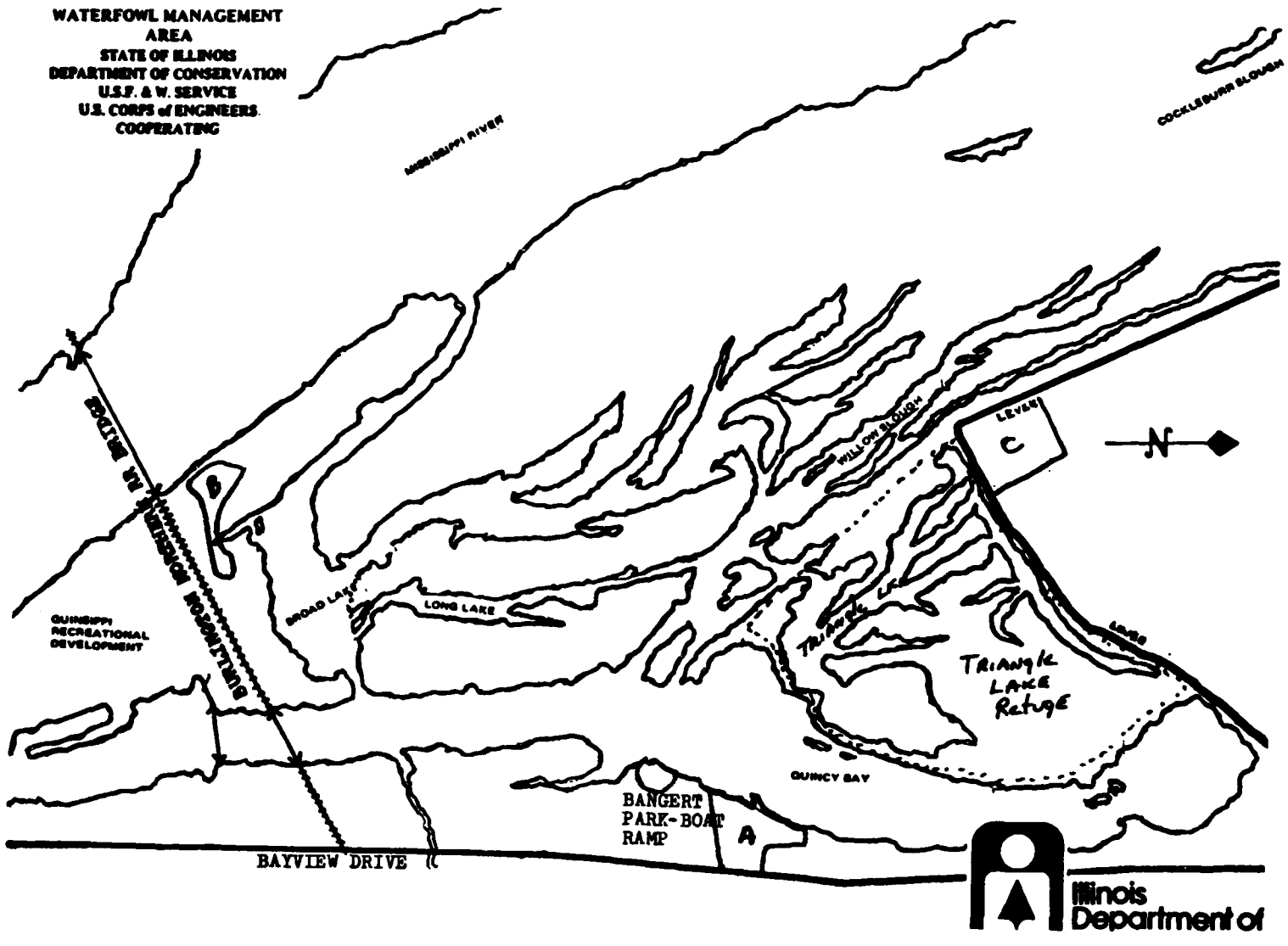
date:

subject:

Area A is an old landfill area located on government property North of the Bob Bangert Park, this area as well as Bangert Park itself has been used for dredge spoil deposit. There is an existing small levee along the Bay that could be used to contain the runoff.

Area B is an area of low wildlife use that is part of the old channel, electro shock surveys have shown a very low aquatic life population using the area.

Area C is an area of existing crop fields and fallow fields that would provide one of the best locations for dredge deposit in the complex.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DEPARTMENT OF CONSERVATION
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COOPERATING
MISSISSIPPI RIVER
COCKLEBURR SLOUGH
MISSISSIPPI RIVER BRIDGE
WILLOW SLOUGH
LEVEE
C
N
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ROAD LAKE
LONG LAKE
TRIANGLE LAKE
LAKE
QUINSIPPI
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WASHINGTON, D. C. 20314-1000

EC 1165-2-140

DAEN-CWR-P

Circular
No. 1165-2-140

5 September 1986

EXPIRES 30 SEPTEMBER 1987

Policy
RECREATION DEVELOPMENT

1. Purpose. This circular sets forth policy concerning Corps of Engineers participation in plans for recreation development.

2. Applicability. This circular is applicable to all HQUSACE/OCE elements and all field operating activities (FOA's) having Civil Works responsibilities.

3. Reference.

a. ER 1105-2-20 (Chapter 6)
b. ER 1165-2-400

4. Background.

a. Administration Policy. One policy initiative of this Administration is to reduce Federal competition with the private and non-Federal public sectors in providing recreation opportunities. The Administration is unable to devote Federal budgetary resources to, nor to support authorization of recreation-oriented projects. Water resources proposals having primarily recreation outputs are inconsistent with this policy.

b. Clarification. In general, project outputs that rely on recreation benefit evaluation procedures will be considered recreation outputs. One exception is with recreational commercial activities, such as charter boat fishing, when the justification is based on changes in net income to the owner/operator. Other exceptions will result from the use of the Contingent Valuation (Survey) Method to evaluate project outputs other than recreation.

5. Guidance. Federal funds shall only be used to support development of recreation facilities when the recreation benefits are less than 50 percent of total benefits. In addition, recreation benefits must be produced either jointly with other project benefits (recreation costs are not separable), or result from development of recreation potential created by projects formulated and justified for other purposes.

6. Procedures.

a. Feasibility and Planning and Engineering Program studies addressing primarily recreation will not be included in the Civil Works budget.

Studies, other than those for multiple purpose reservoirs, that receive funding shall be expeditiously concluded if it is clear that the benefits of separable recreation components are necessary for the project to be economically justified. (The sum of non-recreation benefits and jointly-produced recreation benefits must exceed project costs when separable recreation elements are excluded.) The results of concluded studies shall be furnished to local sponsors for their use.

b. Projects which depend on separable recreation benefits for economic justification, other than those for multiple purpose reservoirs, or for which recreation benefits are greater than 50 percent of total benefits, will not be proposed for inclusion in the Civil Works new construction start program. Recreation projects in Public Law 99-88 for which local cooperation agreements have been executed will be budgeted for follow-on funds in accord with the local cooperation agreements to the maximum extent possible within the overall budgetary ceiling. Recreation facilities at any project in an ongoing construction status, will not be scheduled for construction except under 50/50 sharing of construction costs and 100 percent non-Federal Operation and Maintenance.

c. Recreation facilities at completed projects will only be scheduled when the local sponsor agrees to pay 50 percent of the construction costs and to assume maintenance for the new facility as well as assume existing federal recreation facilities in an amount to offset the amortized Federal share of construction costs.

d. Construction of projects under the Continuing Authorities Program shall not proceed if it is determined that recreation benefits are necessary for economic justification.

7. Additional Guidance.

a. This policy does not modify existing Corps policy on recreation development at major Corps (Corps operated) lakes.

b. This policy does not apply to projects recommended under the special continuing authority provided by Section 14 of the Flood Control Act of 1946, as amended.

c. Federal participation in recreation facilities must be in accord with ER 1165-2-400.

d. Application of this new policy to cases where conflicts exist between legislated and administrative directives, will be addressed by the appropriate HQUSACE element.

FOR THE COMMANDER:

DENNIS J. YORK
for Colonel, Corps of Engineers
Executive Director of Civil Works

QUINCY BAY SEDIMENT AND WATER QUALITY ANALYSIS RESULTS

INTRODUCTION

The U.S. Army Corps of Engineers, Rock Island District, is currently performing a study of the sedimentation problem at Quincy Bay (Illinois). Since alternatives for remedying this problem might involve dredging and the disposal of dredged material, Section 401 Water Quality Certification would be required. In anticipation of this requirement, sediment and water samples were collected at Quincy Bay by Rock Island District Water Quality and Sedimentation Section (ED-HQ) personnel on 17 July 1985. Some sediment samples were collected in conjunction with J. Roger Adams and Bill Bogner of the Illinois State Water Survey (ISWS).

Sediment samples for sieve-size analyses were collected at nine sites as shown in Figure 1. Elutriate analyses were performed on samples collected at five sites and ambient water samples were collected at one site.

METHODS

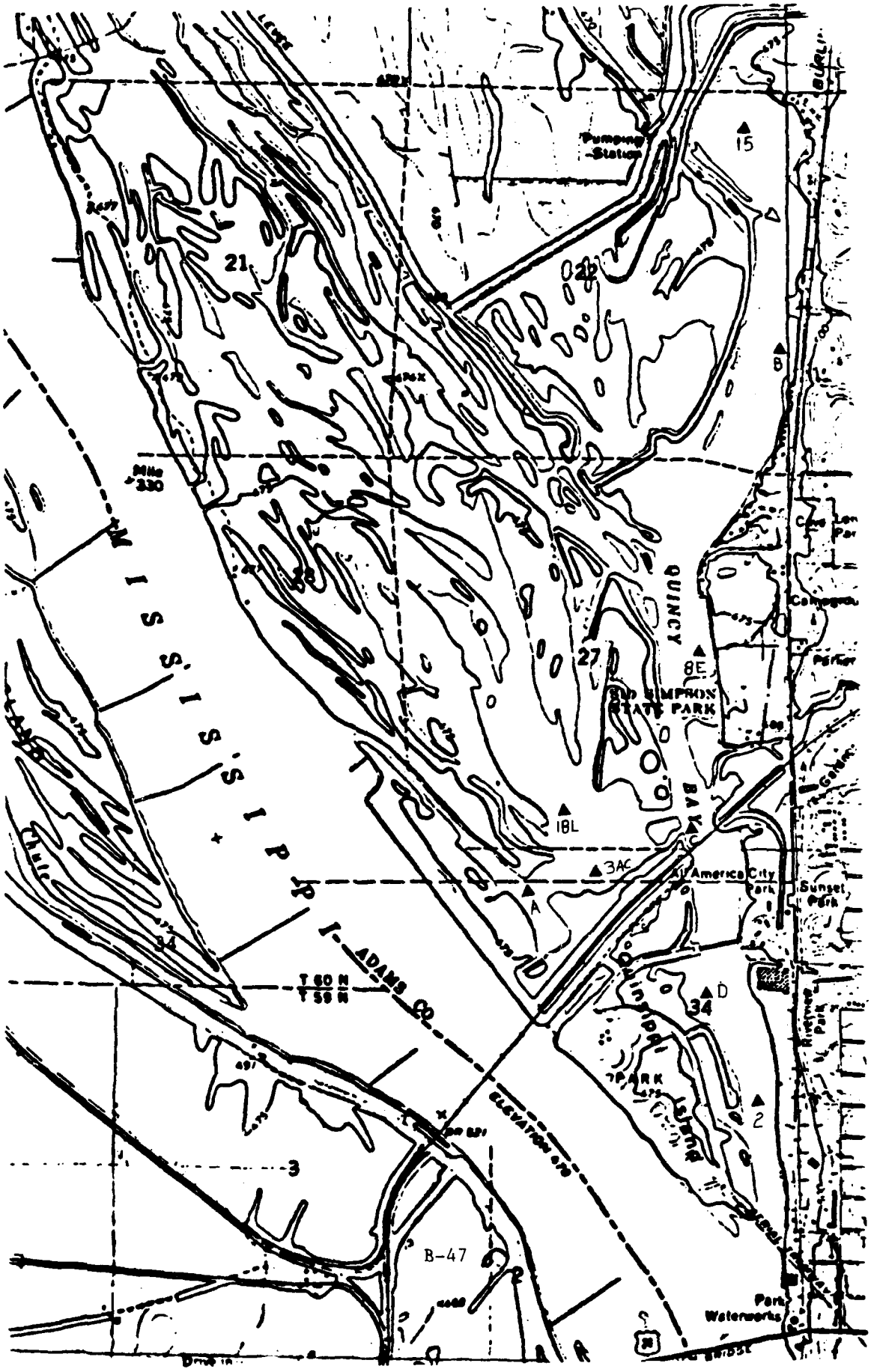
Sediment samples for sieve size analyses were collected at sites A, B, C and D by ED-HQ personnel. Sediment samples were collected at the remaining sites by ISWS personnel. Samples collected by ISWS personnel were split such that ED-HQ performed sieve size and elutriate analyses, while ISWS performed unit dry weight and sieve size analyses.

To collect sediment samples, ED-HQ personnel used a 36-inch core sampler, while ISWS personnel used a 36-inch piston core sampler or an Ekman Dredge. Sediment samples collected by ED-HQ personnel were composites consisting of three subsamples: one collected off the bow of the boat, one amidships, and one off of the stern. Sieve size analyses were performed by Geotechnical Branch personnel on sediment samples collected by ED-HQ in accordance with U.S. Army Corps of Engineers, Engineering Manual 1110-2-1906, Appendix 5, November 1970.

Two water samples were collected by ED-HQ personnel just below the surface at site 8E. Each sample was poured into an appropriate container, preserved as necessary, and placed into an ice chest. Temperature, pH, conductivity and dissolved oxygen were measured in the field. Turbidity determinations were performed in the laboratory immediately following the sampling trip. The following water analyses were performed by Umpqua Research Company, Myrtle Creek, Oregon: oil and grease, total dissolved solids, total suspended solids, volatile suspended solids, ammonia nitrogen and 11 heavy metals.

The elutriate test simulates river conditions during dredging. The test consists of placing 50 ml of a wet, well-mixed sediment sample and 200 ml of process water collected from the same area into a bottle. The mixture is shaken for 30 minutes at maximum speed, allowed to settle for four hours

Figure 1. Quincy Bay sediment sampling locations



and then the supernatant is drawn off and analyzed. The following parameters were analyzed in the elutriate by Umpqua Research Company: oil and grease, total volatile solids, ammonia nitrogen, BOD, PCBs and ten heavy metals. The elutriate test was performed on samples collected at sites 1BL, 2, 3AC, 8E and 15.

Elutriate and ambient water analyses were performed according to Standard Methods for the Examination of Water and Wastewater, 16th Edition, American Public Health Association, Washington, D.C., 1985.

RESULT AND DISCUSSION

Sieve Size Analyses

The results of sieve size analyses performed by the Corps' Geotechnical Branch are shown in Table 1. Six of the ten samples analyzed had greater than 90% passage through a #230 sieve: B, D, 1BL, 8E, 8E(dup.) and 15. These samples consisted primarily of clay. The remaining samples, A, 3AC, C and 2, were collected at channel sites where river velocities were greater; therefore, higher percentages of sand were found at these sites. Site A had the least amount of sediment passing a #230 sieve (1.4%).

The Second Quarterly Report from the Illinois State Water Survey on the Quincy Bay Sedimentation Study is included as an enclosure. This enclosure contains the results of sieve size analyses performed by ISWS personnel. The ISWS sampling locations correspond to Corps sampling locations as follows: Bay Outlet (2), Bangert Ramp (8E), Upper Bay (15), Channel at Broad Lake (3AC) and Broad Lake (1BL). The percent sediment passing a #230 sieve used in the Corps' sieve size analysis is approximately equal to the percent silt plus the percent clay used in the Illinois State Water Survey's sieve size analysis. The sieve size analysis results obtained by both agencies were essentially the same.

Ambient Water Analyses

Table 2 lists the results of ambient water analyses at site 8E. Results of ambient water analyses were evaluated against Illinois General Use Water Quality Standards. There were no violations of these standards. Most heavy metal concentrations were below their respective detection limits. The remaining parameters, both field measured and laboratory analyzed, were at levels which would not adversely impact the environment.

Elutriate Analyses

The elutriate test, which simulates river conditions that would occur during dredging, was performed on six samples. The results of the elutriate analyses, given in Table 3, were evaluated against Illinois General Use Water Quality Standards. Only one elutriate parameter, ammonia (the un-ionized form), had concentrations greater than the state standard. The un-ionized ammonia nitrogen concentrations at sites 1BL (1.66 mg/1), 2 (3.09 mg/1) and 8E (0.75 mg/1 and 0.35 mg/1) exceeded the state standard of 0.04 mg/1.

Most samples had heavy metal concentrations below their respective detection limits. Of the remaining parameters analyzed, only oil and grease had a concentration which would warrant concern. The oil and grease concentration in the elutriate at site 2 (134 mg/1) was significantly greater than those seen at the other sites. Site 2 is located near boat refueling facilities at Riverview Park and Quincy Bay Marina; therefore, it is possible that leakage or spillage during refueling is responsible for the high oil and grease values at this site. Although Illinois does not have a General Use Water Quality Standard for oil and grease, it does have a Secondary Contact and Indigenous Aquatic Life Standard of 15.0 mg/1. Oil and grease concentrations in three samples were greater than this standard: 2 (134 mg/1), 3AC (23 mg/1) and 8E (22 mg/1).

CONCLUSIONS

Results from the elutriate analyses tend to indicate that ammonia (the un-ionized form) would be the only parameter to violate its state standard if dredging was to occur at Quincy Bay. The un-ionized form of ammonia had concentrations which exceeded the state standard at three sites (1BL, 2 and 8E). The percent of ammonia in the un-ionized form is directly related to temperature and pH. The greater the pH and temperature, the greater the percent of ammonia in the un-ionized form. At the time of sampling, temperature (25.2°C) and pH (8.70) were quite high. If actual dredging was to occur during the fall, when temperature and pH values would be significantly lower, un-ionized ammonia concentrations would be lower and therefore, the possibility of violating the state standard at sites 1BL, 2 and 8E would be reduced.

Although there is no General Use Water Quality Standard for oil and grease in Illinois, if dredging were to occur at site 2, oil and grease concentrations might reach undesirable levels.

Table 1. Sieve size analyses results from ten Quincy Bay sediment samples

MISSISSIPPI RIVER
QUINCY, ILLINOIS
GRAIN-SIZE ANALYSES OF SEDIMENT SAMPLES

Summary of Testing

Site Location	Percent Passing No. 230 Sieve	Classification Symbol and Description
A	1.4	SP Brown medium to fine sand
B	99.9	OH Gray organic fat clay
C	29.5	SC Brown clayey sand, trace wood
D	90.3	CL Gray silty lean clay, with wood and sand
1BL	95.0	CL Gray silty lean clay, with leaf fragments, trace wood
2	56.5	CL Gray brown silty lean clay, trace wood, leaf fragments and sand
3AC	5.0	SP Brown fine sand
8E	99.9	CH Gray fat clay
8E (dup.)	99.8	CH Gray fat clay
15	99.9	CH-OH Gray slightly organic fat clay

NOTES:

1. All samples were classified visually in accordance with "The Unified Soil Classification System" (USCS).

2. All samples were oven dried at 60°C drying temperature. This method was employed to produce reliable dry weights for those test samples containing excessive quantities of organic matter in some form.

Table 2. Ambient water analysis results from site 8E in mg/l, unless stated otherwise

Parameter	State * Standard	8E	8E (dup.)
Arsenic	1.0	<0.01	0.01
Barium	5.0	<0.1	<0.1
Cadmium	0.05	<0.001	<0.001
Chromium (+3)	1.0	<0.01	<0.01
Chromium (+6)	0.05	<0.01	<0.01
Copper	0.02	<0.01	<0.01
Lead	0.1	<0.01	<0.01
Mercury	0.0005	<0.0005	<0.0005
Nickel	1.0	<0.01	<0.01
Selenium	1.0	<0.002	<0.002
Zinc	1.0	0.02	0.02
Oil and Grease	-	8	9
Total Dissolved Solids	1,000	202	194
Total Suspended Solids	-	59	55
Volatile Suspended Solids	-	11	10
Ammonia Nitrogen	**	0.05	0.11
pH (-log[H+])	6.5-9.0	8.70	-
Temperature (°C)	-	25.2	-
Conductivity (umhos/cm at 25°C)	-	440	-
Dissolved Oxygen	5.0	13.40	13.88
Turbidity (NTU)	-	35	34

* Illinois General Use Water Quality Standard
** Ammonia nitrogen concentrations less than 1.5 mg/l are lawful regardless of un-ionized ammonia nitrogen concentrations

Table 3. Elutriate analysis results from six Quincy Bay samples in mg/l, unless stated otherwise

Parameter	State * Standard	1BL	2	3AC	8E	8E (dup.)	15
Arsenic	1.0	0.04	0.02	0.02	0.02	0.03	0.02
Barium	5.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.02	<0.01	0.02	0.01	0.01	0.01	<0.01
Lead	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Nickel	1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	1.0	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc	1.0	0.06	0.06	0.07	0.04	0.03	0.03
Oil and Grease	-	12	134	23	22	10	10
BOD	-	8	5	3	6	6	3
Total Volatile Solids	-	252	130	232	204	164	116
PCBs	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Ammonia Nitrogen	**	7.1	13.2	0.10	3.2	1.5	0.67
Un-ionized Ammonia Nitrogen	**	1.66	3.09	-	0.75	0.35	-

* Illinois General Use Water Quality Standard

** If ammonia nitrogen is less than 15 mg/l and greater than or equal to 1.5 mg/l, then un-ionized ammonia nitrogen shall not exceed 0.04 mg/l

SEDIMENTATION INVESTIGATION OF QUINCY BAY

Second Quarterly Report
August 31, 1985

Lake Sedimentation Survey

Four weeks have been spent on a hydrographic survey of Quincy Bay and bottom sediment sampling. Water and sediment depth measurements have been made in Quincy Bay (17 cross sections), Access Channel (8), Willow Slough (7), Broad Lake (2), Long Lake (2), and Triangle Lake (2). Bottom sediment samples were collected at most cross sections. These samples are being analyzed for particle size distribution and unit weight. In mid-July bottom samples were collected in cooperation with a field crew from the Rock Island District, U.S. Army Corps of Engineers. Their samples are being analyzed for chemical quality to determine the practicality of dredging and any problems with dredged material disposal.

The field data is being reduced and cross-sectional plots and a hydrographic map are being prepared. In many places the depth of sediment is clearly defined, though in some locations where over 10 ft of sediment have accumulated the total depth is not defined by the survey. An aluminum sounding rod with a sliding sediment shoe is used to measure both water and sediment depth at 25-ft intervals along each cross section.

Broad and Triangle Lakes are so shallow that only a few cross sections could be measured. We were also delayed by a mechanical breakdown. The 20-horsepower outboard had a main bearing seize on July 18. The powerhead has been replaced and the motor is back in use. However, this did delay completion of the lake sedimentation field data collection.

The bottom material samples collected at five sites in conjunction with the Corps of Engineers have been analyzed for physical characteristics. Table 1 summarizes these results. These samples were obtained with a 2-inch diameter piston core with a 3-ft barrel or an Ekman dredge. The range in composition from 99% sand to 71% clay represents hydraulic conditions between high velocity channel and a still lake. The sand in the channel south of broad lake has the highest unit weight of 89 pounds per cubic foot while the fine, near-surface material in the upper bay has a unit weight of only 26

pounds per cubic foot. The upper bay site and the one off the boat ramp in Bangert Park show consolidation with depth which is typical of fine sediments in lakes.

Coordination

A coordination meeting was held at the offices of the Rock Island District, Corps of Engineers on August 29, 1985. Richard Watson, Corps Study Manager, Bob Vanderjack, Pat Burke, Marvin Martens, Nelson Cordoba, and Kenneth Younker of the Rock Island District attended. Others present were: Rodger Adams, State Water Survey; Lee Osborn and William Klingner, Quincy Park District; and Dick Westfall, Illinois Department of Conservation, and their consultant, Linda Huff of Huff and Huff.

Watson and Burke described the Corps study progress to date and their intent to evaluate problems and possible solutions in FY86. They hope to have a draft report prepared in March, 1986. Their evaluation of solutions depends on the results of this Water Survey study of sedimentation for DOC.

Adams outlined progress on lake sedimentation survey as given in more detail in this progress report. The next quarterly report will contain the results of this survey. Suspended sediment loads through the access channel and bay outlet are being measured, but results are not available.

Huff described their user survey of recreational boaters using Quincy area ramps and marinas. They have interviewed over 1000 boaters and surveyed more on a launch-use basis. Once the fall hunting season is over, they will prepare their final report for DOC review by January 31, 1986.

A general discussion of the need for a public meeting lead to a deferral until such time as more factual information is ready for presentation. A short news release was agreed upon as a near-term alternative. Each agency will forward a half page to Watson for integration into the news release.

Table 1. Bed Material Characterisitcs, Quincy Bay

Location	Water depth (feet)	Sample depth (feet)	Unit dry weight (lb/ft^3)	% in each class			Median diameter mm
				Sand	Silt	Clay	
Bay Outlet	11	S*	-	45.0	40.5	14.5	0.055
		1.0	63.8	-	-	-	-
		1.3	-	12.7	45.4	41.9	0.007
Bangert Ramp	3	S	-	0.1	51.8	48.1	0.005
		0.3	38.2	-	-	-	-
		1.7	-	0.3	48.5	51.2	0.004
		1.9	43.8	-	-	-	-
Upper Bay	3	S	-	0.2	28.6	71.2	<0.002
		0.3	25.8	-	-	-	-
		1.7	-	0.1	29.5	70.4	<0.002
		1.9	45.3	-	-	-	-
Channel at Broad Lake	5	S	-	99.2	0.8	0	0.320
		0.3	89.9	-	-	-	-
		0.7	-	98.8	1.2	0	0.300
		1.1	89.6	-	-	-	-
		1.4	-	98.6	1.1	0	0.350
Broad Lake	1	S	-	2.6	88.3	19.1	0.022
		0.3	48.1	-	-	-	-
		1.0	-	0.3	63.6	36.1	0.010
		1.9	47.9	-	-	-	-
		2.2	-	0.1	64.9	35.0	0.008

*S = Surface

Quincy Bay Sedimentation Study
Quarterly Report Distribution

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